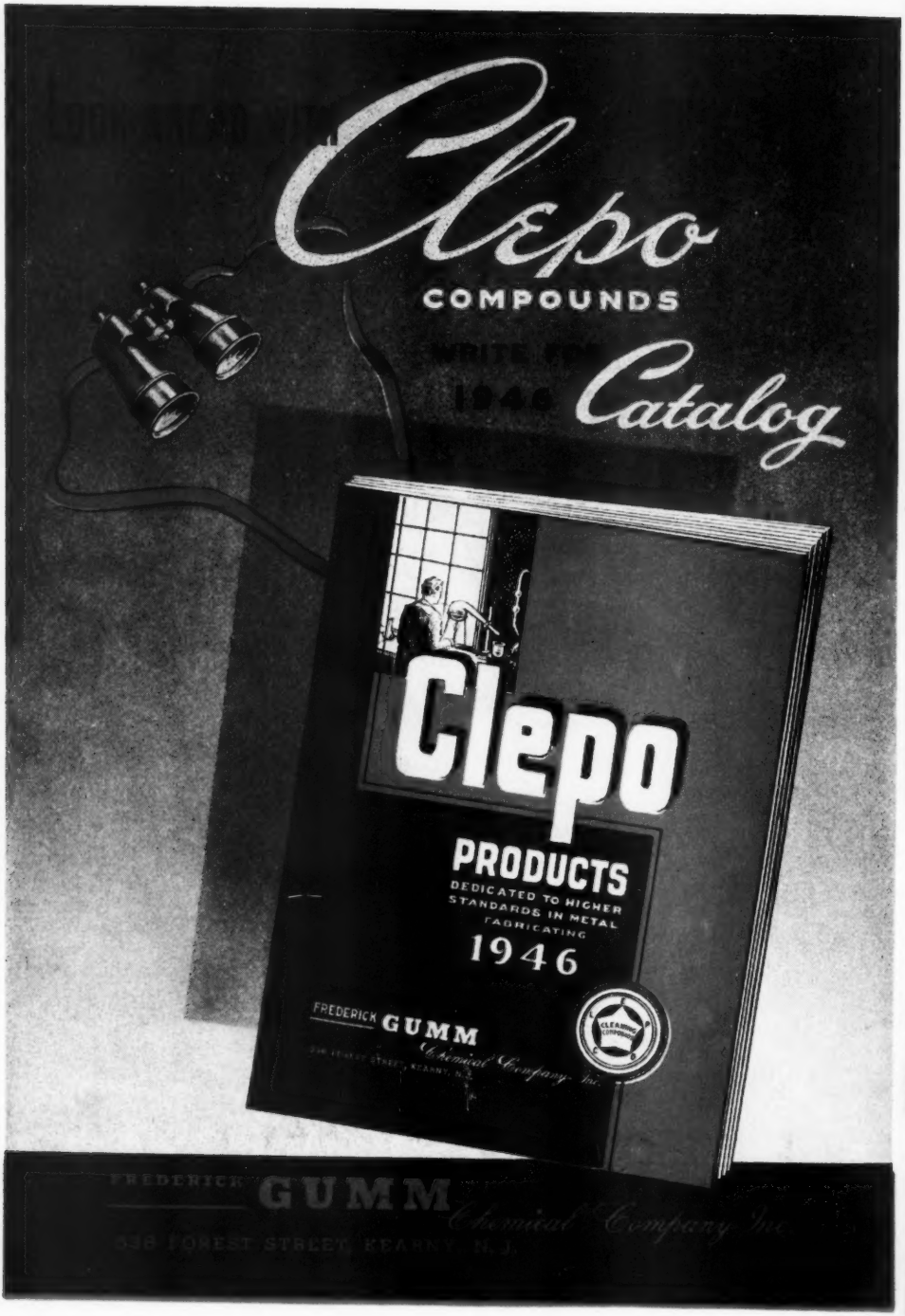
THE MONTHLY Review

Important Notice

Effective with the July issue MONTHLY REVIEW will be mailed on the 1st of each month. Deadline for all manuscript and advertising matter will be the 12th of the month preceding publication. Further details in next issue.

Official Organ of the American Electroplaters' Society
A Society for the Advancement of the Science of Electroplating

APRIL • • • 1946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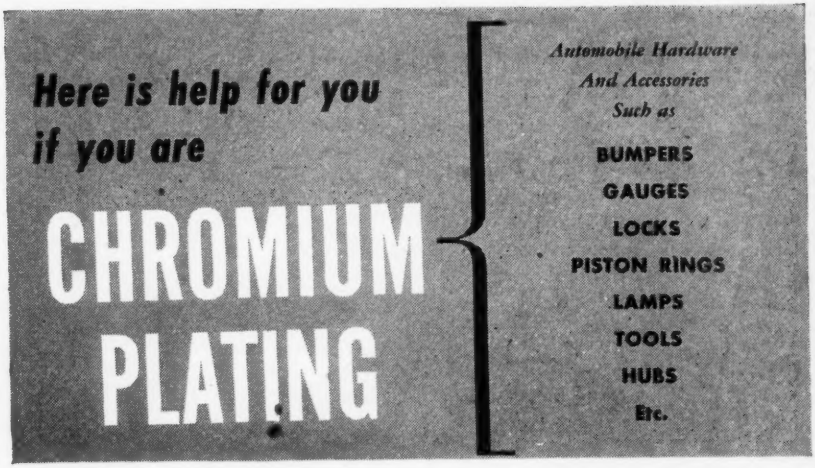

GOOD results in chromium plating depend to an important degree on proper preparation of the base steel. Surfaces must be CHEMICALLY CLEAN in order to assure maximum deposit adhesion. You can be sure of the thoroughness of your preliminary surface cleaning process by following the example of many leading platers who use that fast-acting Oakite material especially designed for ANODIC degreasing . . .

OAKITE COMPOSITION No. 90

The highly effective wetting-out, emulsifying and penetrating properties of this material quickly remove insoluble smut, oil, grease, shop dirt and similar foreign matter. The resulting CHEMICALLY CLEAN surfaces provide uniform, durable chrome deposits on ferrous metals. For plating on non-ferrous metals equally effective Oakite materials are available. Complete technical data gladly supplied on request.

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A 16-page booklet describing Oakite Composition No. 90 may be had FREE on request. In addition, the personal services of your nearby Oakite Technical Representative are available to you entirely without cost or obligation. Your inquiries are invited . . . promptly answered. Write TODAY!

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ALL THESE ADVANTAGES FOR
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3. LOW OPERATING COSTS—replenishment costs where suitable equipment is used may be unusually low; only from 5 to 10 lb. of potassium cyanide or sodium cyanide per 5,000 gallons of solution per day!

4. HIGH THROWING POWER—superior throwing power of the cyanide solutions is a typical characteristic of this process.

5. NO VENTILATION PROBLEM—Potassium and Sodium High Speed, Copper Baths do not evolve poisonous or objectionable fumes.

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for ELECTROPLATING

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POLISHING, BUFFING, COLORING, and DEBURRING COMPOSITIONS.
you can rest assured that it carries a two-fold guarantee of extra quality . . . laboratory control of raw materials —combined in proper percentages and tested under actual working conditions to assure the best obtainable results in your finishing operations.
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THE MONTHLY

Review

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CONTENTS

Convention News 371
Hotel Reservation Blank 372
HAZEL & STERICKER—Electrolytic Cleaning of Zinc & Zinc Alloys in Alkaline Baths 373
Electroplating at A.S.T.M. Spring Meeting 391
STRUYK—Copper-Tin Alloy Plating 394
MOLINE—Corrosion Resistance of Chromium Plated & Surface Conditioned 13% Cr Steel 401
BLUM—Health Hazards in Electroplating 411
GLASSTONE—Cadmium Whiskers .. 417
Correction for "Adhesion of Electrodeposits" by Faust, in March issue 417
Convention Exhibits Appeal 417
Proposed Revision of By-Laws 419
Permanent Charters Awarded 431
Regional Meetings Announced 414, 436
Back Issues Requested 453

DEPARTMENTS

Readers' Corner 417
Abstracts 421
Book Review 425
Branch News 427
Membership Report 433
Industry News 439
Branch & A.E.S. Officers Directory 455
Advertisers Index 461

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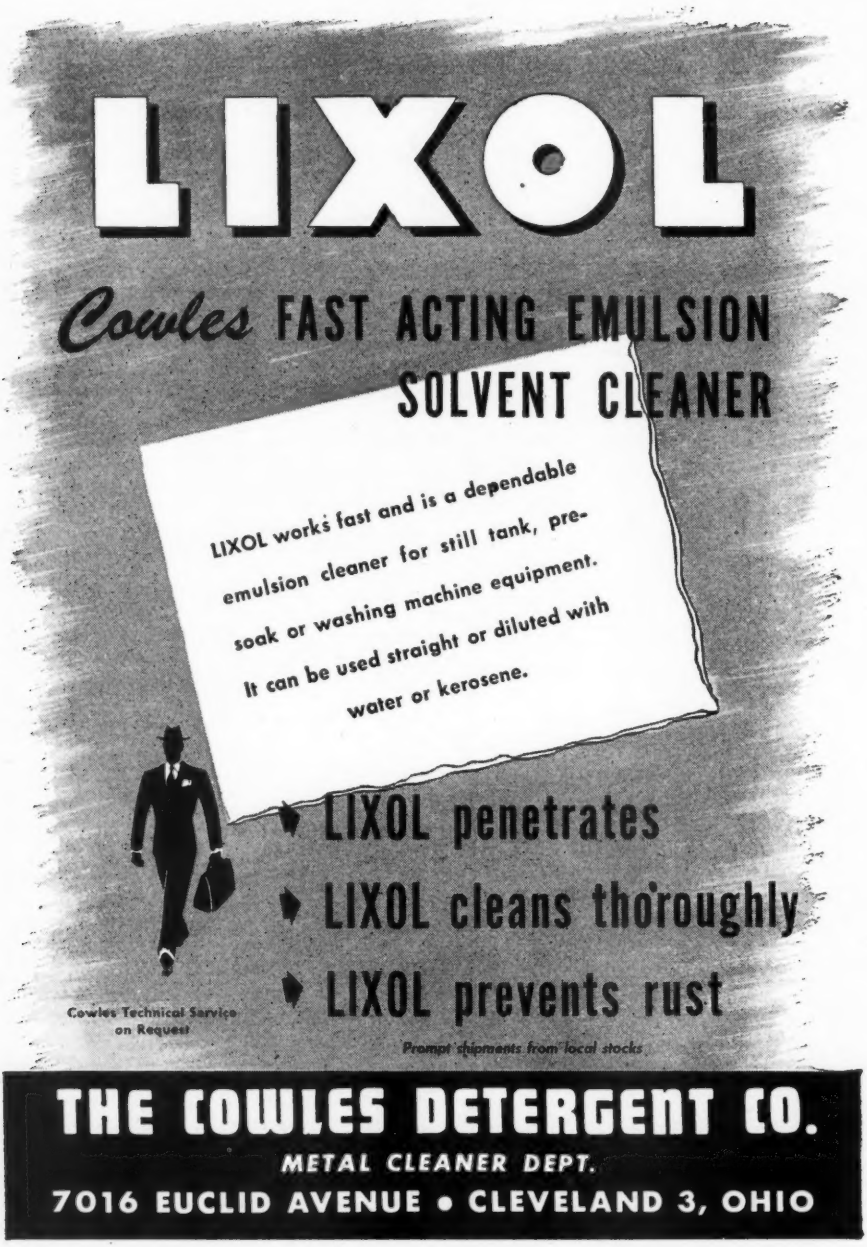
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Cowles FAST ACTING EMULSION
SOLVENT CLEANER
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Safe on any surface

THERE'S one metal cleaner that just doesn't fall down on the job. That's Wyandotte Metal Cleaner No. 38. This *balanced* product can solve practically all the cleaning needs of the average plant with economy and efficiency.

Wyandotte Metal Cleaner No. 38 is all-soluble. It dissolves quickly, rinses easily and completely. It is designed to correct water conditions . . . wet rapidly . . . give long life in solution. It is inhibited to prevent corrosion of the metal being treated.

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Let your Wyandotte Representative tell you more about the advantages of Wyandotte Metal Cleaner No. 38. He's always at your service.

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Panels coated with the materials to be tested are mounted on a table which revolves at constant speed under two abrasive wheels. The number of revolutions necessary to wear through a given film thickness provides a measure of the resistance of any given finishing material to mechanical abrasion.

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Write for leaflet UC for full details

SPEEDY! Copper deposits are quickly built up at high current densities. Unichrome Alkaline Copper operates over a wide range of current densities, permitting high speed plating without roughening or burning the deposits. Anode and cathode efficiency is 100%, and anode corrosion is excellent.

SIMPLE! The bath is stable, reliable and easily controlled. It's not sensitive to impurities, nor does it build up carbonate—even though air agitated. And you use your existing equipment.

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☆**ANOZINC** salts for anodic treatment of zinc giving greatly increased corrosion resistance.

☆**UNICHROME DIP** for increased corrosion resistance of zinc and cadmium—without electric current.

☆**UNICHROME STRIP** for speedy removal of copper and chromium.

☆**UNICHROME RACK COATINGS!**

☆**UNICHROME STOP-OFF LACQUERS AND COMPOUNDS**

☆**UNICHROME CLEAR LACQUERS**

☆**UCILON** — a corrosion-resistant coating for protecting surfaces against acids, alkalies, water, gasoline, various corrosive chemicals.

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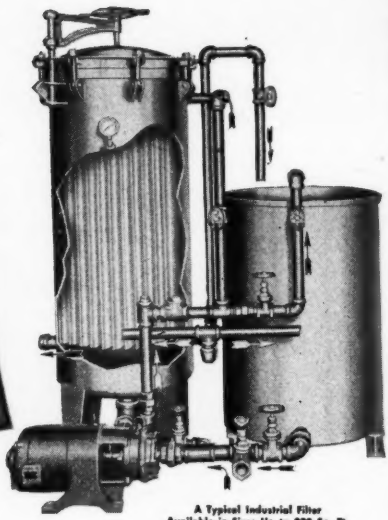
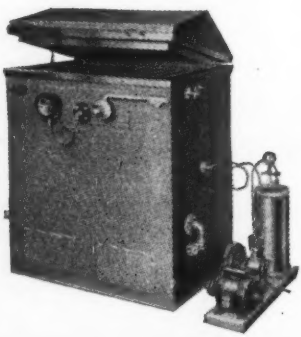


A Typical Industrial Filter
Available in Sizes Up to 290 Sq. Ft.
of Filtration Area

HERE IS GOOD NEWS FROM THE PLATING FRONT!

Industrial Plating Solution Filters are now coming equipped with AIRWASH — the new cleaning device that does a thorough job in a few minutes without opening the filter. You will welcome this new labor saving method of cleaning filters. The Industrial AIRWASH Device does a complete job of removing cake and sludge from filter cloths. There is no loss of time before starting the new filter cycle. Industrial Filters are furnished in sizes and models to fit your needs. Ask for our recommendations on the proper equipment to do your job better.



SALT FOG
Corrosion Test Equipment

This modern instrument is designed to meet all requirements of latest "Salt Fog Testing Procedure Specifications" to determine corrosion resistance of plated, coated, lacquered or painted parts.

Serious rejection losses on industrial finishes which must meet Army or Navy specifications are avoided by systematic tests with Industrial Salt Fog Test Equipment.

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No. 1—48" long 26" wide 36" deep No. 3—30" long 18" wide 30" deep
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INDUSTRIAL FILTER & PUMP MFG. CO.

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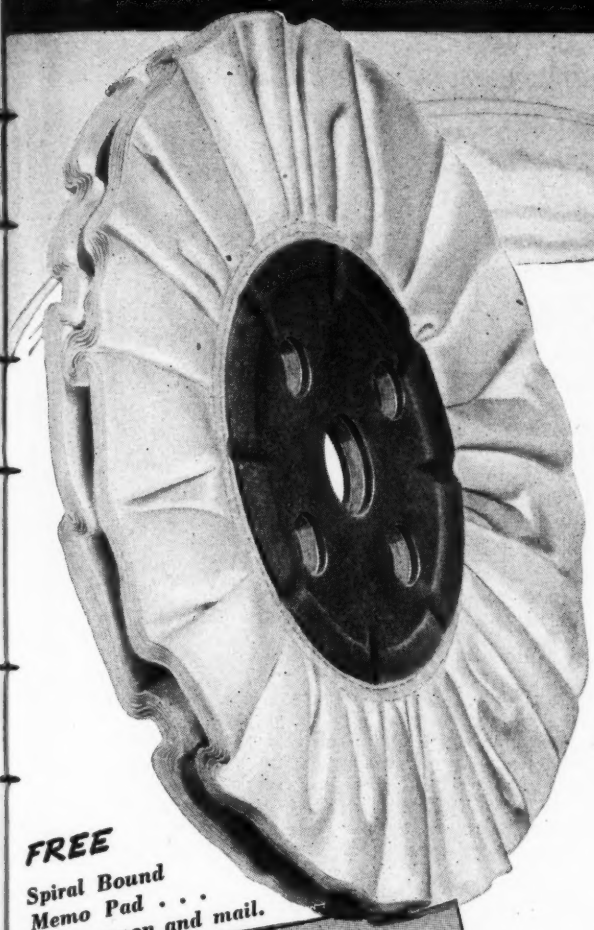

FOR HIGH SPEEDS

Like the super-fast modern planes . . . Codman Ventilated *Non-Fray* Buffs are built for speed.

- **These perfected *Non-Fray* buffs have been scientifically designed and tested to allow proper ventilation at high speeds.**
- **They have no equals for efficiency and stamina at high speeds.**

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*PATENT NOS. 2,027,863; 2,094,650; 1,573,961; RE. 19,894; 2,140,208

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PROSALT COPPER

Here is a "work-horse" copper bath for use with direct current. Has all the advantages of the Rochelle bath PLUS (1) Broader operating range; (2) Lower optimum temperature; (3) Finer grained, lighter color, more ductile deposits. Existing Rochelle baths may be converted by the addition of 130 cc. Prosalt per gallon.

Make-Up Analysis Prosalt Copper Bath	*Cost*
Copper cyanide, 3.5 ounces per gallon	$0.0764
Sodium cyanide, 4.6 ounces per gallon	0.049
Sodium carbonate, 4.0 ounces per gallon	0.0075
PROSALT, 130 cc. per gallon	0.184
	$0.3169 per gallon

Ideal for copper strike; stop-off for heat treat; copper to be buffed—Sufficiently bright for direct deposit of bright nickel on polished surfaces.

Prosalt available f.o.b. Waukegan, Illinois, in twelve gallon carboys at $5.35 per gallon.

PRO-SEAL

Pro-Seal meets the refrigerator manufacturers' specification for shelf finish when applied to zinc plated shelves. Produces long lasting, beautifully brilliant finish on zinc plated shelves and parts. Pro-Seal creates thousands of new uses and applications of PROTECTED bright ZINC or CADMIUM plated products—suitable for use on barrel-plated parts—uses no current—simplifies production—can be hot rinsed or oven dried—easy to control and economical to operate.

ZINC AND CADMIUM

Promat Basic Addition Agents for zinc and cadmium baths now available for use with Direct Current. Allows use of higher current density resulting in an increase in the capacity of existing tanks.

THE PROMAT LINE

The Promat line also includes electro-cleaners for steel, die castings and aluminum, soak cleaners; Pre-treat for stainless steel; "Z" Black, concentrated electrolytes and maintenance solutions for zinc, cadmium and copper.

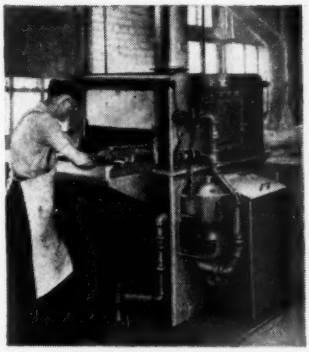
Representatives in principal cities. Write to:

PROMAT DIVISION — Poor & Company

851 SOUTH MARKET STREET WAUKEGAN, ILLINOIS

CUTS REJECT COSTS
SAVES TIME

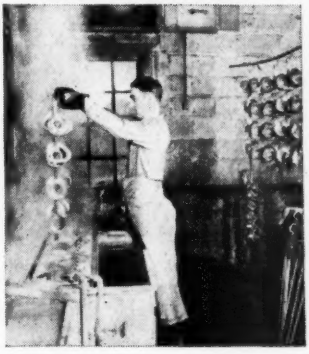
Triad 93 and Triad 66
PRE-FINISHING COMBINATION FOR Die Castings



Modern plating set-ups incorporate two Triad alkali compounds in their pre-plate cleaning operations.

Triad 93, an emulsion used in a single-stage spray washer or still tank, wets out drawing compounds and insoluble buffing materials from die castings.

Triad 66, in electrolytic cleaning tanks, prepares the metal surfaces for the plater. It can be used with direct or reverse current, and offers complete wetting, excellent rinsing and hard water control. The combination saves time and cuts reject costs.



Write today for information to aid in solving your cleaning problem.

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A newly improved black oxide finish for zinc. By penetrating into the metal, this compound assures you of obtaining a deep, glossy black finish that will not flake off. Write for detailed information and see how Purico Zn can help you obtain a high quality finish on your zinc products.

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ANODIC CLEANER

Another Puritan cleaner that will aid the manufacturer in obtaining a bright, lustrous finish for his products. This fast, economical reverse current cleaner is designed especially for detinning prior to plating.

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SESSIONS-GIFFORD CO.
Providence

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THE Puritan
MANUFACTURING COMPANY
WATERBURY, CONNECTICUT

New, Improved Rubber Lined Filter

"Horizontal Plate" Design

developed by SPARKLER especially for filtration of Plating Solutions

If you are not now using Sparkler Filters, it will pay you to investigate the exceptional performance and stability of this new rubber-lined filter. It is designed to do a better job of reconditioning any and every kind of solution, enabling you to maintain highest quality, brilliancy and surface smoothness at all times.

Let a Sparkler engineer help you with your filtration problems.

Write for any special information.

SPARKLER MANUFACTURING COMPANY

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SPARKLER HORIZONTAL PLATE FILTERS

BODYGUARD FOR RACKS

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Protects them from Punishing Plating Cycles

Compounded of new and improved resins, Unichrome Coating 202 has exceptional chemical resistance, unusual toughness and superior adhesion. Even with high-temperature plating solutions, corrosive anodizing baths and severe cleaning cycles, your racks will enjoy a longer, more useful life when insulated with this coating. This means important hours saved and money in your pocket.

Check (right) the properties of Unichrome Coating 202. Order a trial shipment now and put your racks in shape to do a better, longer job for you. Our nearest office will gladly supply information and prices.

*Trade Mark Reg. U.S. Pat. Off.

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PROPERTIES

Chemical Resistance—Excellent for all plating cycles.

Toughness—Withstands repeated flexing and shop handling—cuts cleanly and easily at contacts.

Drying—Dipped at room temperature in container in which it is shipped—force dried at 200°F. for extra protection.

Adherence—Excellent for severe cycles. For moderate cycles "Air Dry" coating is recommended.

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Unichrome Air-Dry Rack Coating 203—can be dipped and dried at room temperature, for use in all plating solutions.

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Unichrome Quick Dry Stop-Off 323—for chromium and other work requiring a stop-off that can be peeled off.

Unichrome Quick Dry Stop-Off 324—for high temperature solutions. It also resists vapor degreasers for a limited time.

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NICKEL CARBONATE

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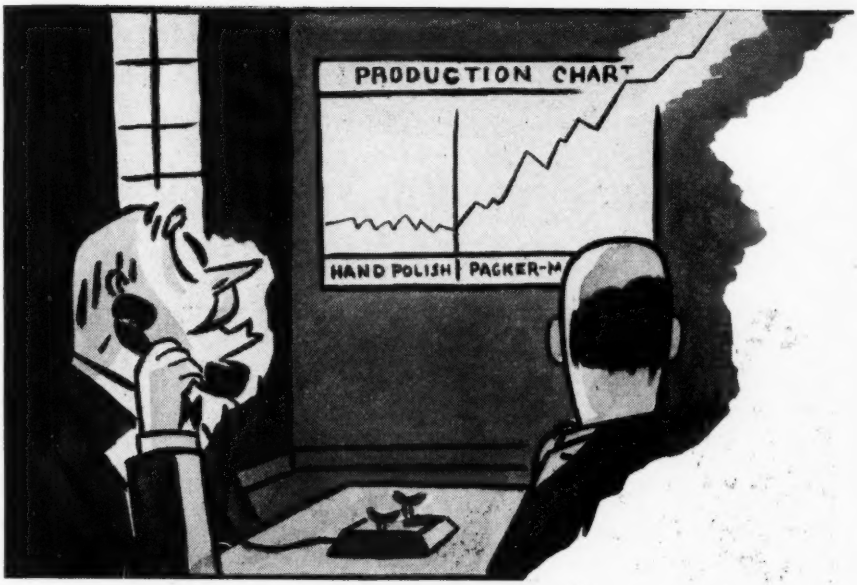
FOR IMMEDIATE SHIPMENT

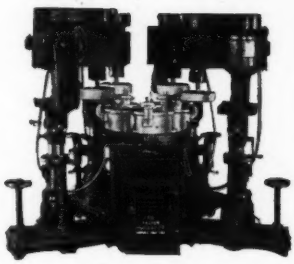
Also Prompt Deliveries

On All Types of Nickel Anodes

Cast McGEAN Besplates	99% Plus
Rolled Depolarized	99% Plus
Rocarb (Rolled Carbonized) .	99% Plus
Cast Ovals—Special Shapes .	95 / 97%

THE McGEAN CHEMICAL COMPANY
CLEVELAND 15, OHIO





No. 4-5 INDEXING TYPE WITH OSCILLATING WHEEL HEADS

There's a Packer-Matic for all shapes, metals and finishes. WRITE for Factory Time Study — SEND part and finish desired to Packer Machine Co., Meriden, Ct.

"QUICK O'FLYNN, STOP THAT PACKER-MATIC BEFORE PRODUCTION GOES THRU THE ROOF!"

Your production, too, will soar to new heights when you install Packer-Matic Automatic Polishing and Buffing Machines. But that's not all — you eliminate costly and uncertain free hand operations, insure a uniformly high quality finish and lower both labor and wheel costs! Too good to be true? It seems so until you get the facts.

THE PACKER MACHINE CO. MERIDEN, CONN.

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. . . THE FINAL TOUCH OF PERFECTION THAT MAKES PLASTICS SELL FASTER!

Plastics look their best, and sell fastest, when they have the added surface beauty of a very fine finish like CODUR.

CODUR is a line of high-gloss, synthetic baking enamels especially designed for a one-spray coat application on molded (phenol formaldehyde) plastics. They have excellent color retention and bake to a very hard mar-resistant surface. CODUR is available in most colors in plain enamels and many metallic colors. M & W also offers air-drying or baking finishes for other plastics: acetates, butyrates, methacrylates and others.

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PRODUCERS OF LACQUERS, ENAMELS, SYNTHETICS AND SPECIAL PRODUCTION FINISHES

CONVENTION *News*

Hotel Reservations

WITHIN the last month, the hotel situation in Pittsburgh has significantly improved, but it is still below the normal standard. This condition of course prevails not only in Pittsburgh, it is nation-wide.

In order to guarantee every one who attends the Convention the best possible hotel facilities your Committee has requested Pittsburgh Convention and Tourist Bureau to assist in this important function. Hotel Reservation Forms have already been mailed out. If you failed to receive your form use the duplicate on the back of this page. If you plan to attend, please fill out the form at your earliest convenience and return to Miss Jane C. Walsh of the Pittsburgh Convention and Tourist Bureau, since *no* reservations will be accepted directly by hotels.

We sincerely regret that present circumstances necessitate such action, but we feel certain that every registrant will be comfortably housed in a first class hotel, *if* he will cooperate by using this form and thus give us advance notice.

We respectfully suggest that you read this Reservation Form carefully, particularly that part relating to doubling up by friends or by representatives of the same company.

The complete release of Pullman travel from ODT restrictions should further help to alleviate the hotel situation, but your Committee is taking advantage of every precautionary measure to insure your comfort and security.

* * *

The Ladies' Committee is rapidly rounding out an interesting program for the wives and sweethearts, highlights of which will be a tour through the H. J. Heinz plant and a trip to the Buhl Planetarium.

Previously, we have assured you that Pittsburgh would endeavor to adhere to the scheduled program as closely as possible and we take this opportunity to renew our assurances. We will do our best to start all functions on time.

The date of the Convention is approaching rapidly, so crystallize your plans now. We are anxiously awaiting the pleasure of seeing you all in Pittsburgh and we hope to make your visit worthwhile in every way.

WILLIAM J. HENNESSY,
Publicity Chairman, A.E.S. Convention

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HOTEL	*Single*[1]	*Double*	*Twin Beds*
William Penn	$3.85 to $7.70	$5.50 to $8.80	$6.60 to $11.00
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ELECTROLYTIC CLEANING OF ZINC AND ZINC ALLOYS

in Alkaline Baths

By FRED HAZEL[1] and WILLIAM STERICKER[2]

INTRODUCTION

THERE has been considerable disagreement in the past eight or ten years as to whether zinc die castings should be cleaned with sodium silicates or even with compounds containing them. Some platers reported good results, others refused to use any silicates in their cleaning baths. It appeared that there might be conditions under which difficulty would be experienced, and others under which good results would be obtained. The experiments described hereinafter were undertaken to determine whether or not these conditions could be defined. If this could not be done, or if the range for good results were too narrow, then the use of silicates should not be recommended. Naturally some comparison with other commonly used alkaline materials was necessary.

MATERIALS AND METHODS

Metals

Due to the lack of alloy much of the early work was done with unalloyed zinc sheet. Later both aluminum-zinc and aluminum-copper-zinc alloy castings were used. All of these were supplied by the New Jersey Zinc Company. The analyses are given in Table I.

TABLE I

Analysis of Zinc and Zinc Alloys

Constituent	Sheet Zinc %	Alloy No.* XXIII %	Alloy No.* XXV %
Aluminum	—	4.0	4.1
Copper	0.0004	<0.1	1.0
Magnesium	—	0.03-0.06	0.04
Iron	0.007	<0.100	0.03
Lead	0.089	<0.007	<0.007
Cadmium	0.0052	<0.005	<0.005
Tin	—	<0.005	<0.005

*ASTM Designation B86-43.

The cast alloys had a dull surface in contrast with the specular surface of the zinc sheet. They reacted more rapidly with caustic soda than did the zinc, thereby indicating greater sensitivity to alkaline materials. However, in general, the results obtained with the three types of metal were very similar. Any exceptions which were found, are noted under "Results".

Chemicals

All silicates were commercial products of known characteristics shown in Table II. In the following they will be designated by the approximate mol ratio between the sodium oxide (Na_2O) and the silica (SiO_2). Thus 3:2 silicate will stand for Metso 99, 1:1 silicate for Metso granular, etc. The sodium hexametaphosphate was unadjusted Calgon obtained from Calgon, Inc. and the sodium tetraphosphate was Quadrafos made by Rumford Chemical Works. The other chemicals were J. T. Baker's "Analyzed" grade. The caustic soda was in the form of pellets, which were supposed to assay 98.8% sodium hydroxide (NaOH) and 1.3% sodium carbonate (Na_2CO_3). The trisodium phosphate consisted of the hydrate $Na_3PO_4.12H_2O$ with a small excess (1.7%) of sodium hydroxide. The pyrophosphate also was hydrated, $Na_4P_2O_7.10H_2O$. The sodium carbonate was anhydrous, corresponding to commercial soda ash.

Methods

Effects of solutions of the various materials on zinc were determined while passing a current through the solution in question between two zinc or zinc alloy electrodes which usually were of the same composition. The zinc sheet was cut into small electrodes, most of which were 2.5 cm (1 in.) wide. These were immersed to a depth of 5 cm (2 in.). A few electrodes of other widths were used but in any given

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experiment the anode and the cathode had the same area. The beaker in which the solution was contained was kept in a water bath. In this way the indicated temperature was maintained ± 2°F at the high values and even closer at the low.

The current was supplied from a set of storage batteries with outside resistance which was regulated so that the desired current density was secured. For the bulk of the experiments this was approximately one ampere per square decimeter (9.3 amperes per square foot). Unless otherwise noted, the current was allowed to flow for five minutes without further adjustment. It is recognized that this is longer than the time available in many automatic machines, but it was felt that it would accentuate the formation of deposits.

With the alloy casting, the methods were not changed. However, three different widths of electrodes were used: 1.2, 1.8 and 2.5 cm (½, 0.7 and 1 in.). The thickness of the casting (0.3 cm, 0.12 in.) was taken into account in calculating the surface area. When deposits formed, they appeared first on freshly cut edges. The casting skin seemed to be somewhat more resistant. Hence an effort was made to use electrodes with little or not cut surface immersed in the solution.

EFFECTS ON ZINC AND ZINC ALLOYS

Effect of Silicate Ratio

Since the commercial sodium silicates vary greatly in chemical composition and properties, the first step was to determine which silicates, if any, could be used safely on zinc. Earlier work by Baker[1] indicated that sodium metasilicate attacked zinc less at 140°F (60°C) than less alkaline silicates. On the other hand, it is well known that silicates more alkaline than the metasilicate attack aluminum, while those which are less alkaline act as inhibitors in the presence of other alkaline materials which do attack by themselves. In the first experiments, four silicates were used, the composition and properties of which are summarized in Table II. Concentrations of four ounces per gallon (3%) were employed.

All the cathodes (Fig. 1) were bright and specular as were the anodes (Fig. 2) which had been immersed in the 3:2 and the 1:1 silicate solutions. The anodes which were treated in solutions of the 1:2 and 1:3⅓ silicates were coated with heavy white deposits. To determine whether the deposits were caused by a higher silica concentration, more dilute solutions of the 1:2 and 1:3⅓ silicates were prepared. These contained the same amount of silica as was present in the 3% solution of the 1:1 silicate. When zinc was used as an anode in these solutions, deposits were obtained similar to those at the higher concentration. The principal difference was that there was in a lesser quantity of deposit. These anodes are exhibited in Fig. 3.

On addition of sufficient sodium hydroxide to these solutions to bring the $NaO:SiO_2$ ratio to the same value as that in the solution of the 1:1 silicate, the deposits no longer formed (Fig. 3). However, both anodes were darkened to some extent, and were not as bright as those obtained from a solution of 1:1 silicate. The degree of darkening was greater with the mixture of 1:2 silicate and caustic than it was with

TABLE II

Composition of Sodium Silicates

Name	Na_2O %	SiO_2 %	H_2O %	$Na_2O:SiO_2$ Ratio		Trade Designation
				%	Molecular	
Sodium sesquisilicate hydrate	36.9	24.0	38.6	1:0.65	3:2.00	Metso 99
Sodium metasilicate pentahydrate	29.5	28.7	41.7	1:0.97	1:1.00	Metso Granular
Hydrated sodium disilicate	27.5	55.0	17.5	1:2.00	1:2.06	GC Brand
Hydrated sodium "trisilicate"	19.4	62.5	17.5	1:3.22	1:3.32	G Brand

the 1:3⅓ silicate and caustic. In fact, the latter was nearly as bright and specular as the anode from the solution of 1:1 silicate. These experiments show that the hydrated colloidal silicates containing two or more molecules of silica per molecule of sodium oxide should not be used in cleaners for zinc in electrolytic baths, at least if the metal is anodic (reverse cleaning). The use of powdered anhydrous silicate glasses of these ratios would be even more unsatisfactory.

Since both the 1:2 and the 1:3⅓ silicates are made by spray-drying of solutions, the question was raised whether something in the process was responsible for the formation of the deposits. This was checked by diluting solutions of the 1:2 silicate, such as would be used in the manufacture of the 1:2 silicate powder to the same total solids content as contained in 3% solutions of powder. Deposits from this solution were of the same type and in the same amount as from solutions of the dried material. This proved that it was the silicate ratio and not the method of manufacture that caused the deposits.

The possibility of there being invisible films on the metal surfaces on which there were no visible deposits was investigated carefully. Neither the anodes nor the cathodes from cells containing 3% solutions

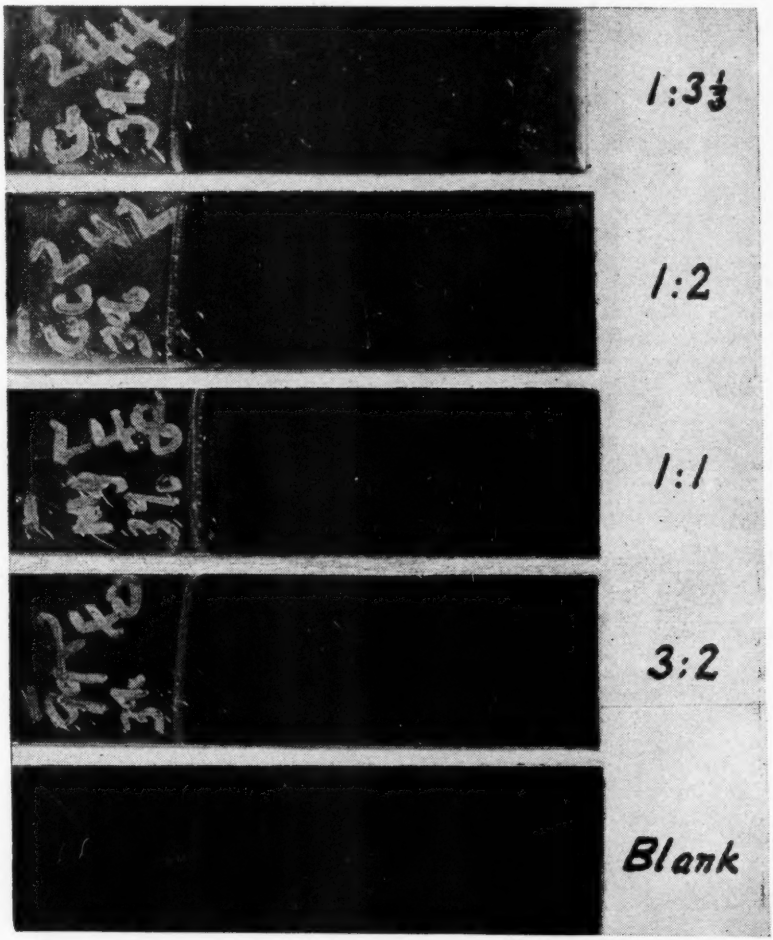

Fig. 1. Effect of silicate ratio on zinc cathodes in 3% solutions at 194°F.

of 3:2 or 1:1 silicates had such films. Experiments under other conditions demonstrated that the method used would detect extremely small amounts of silica, such as would occur in films 1-3 x 10^{-6} cm thick.

When Alloy No. XXIII was used in place of sheet zinc, no deposits were formed in solutions of either 3:2 or 1:1 silicates. With 3% 1:2 silicate a patchy white deposit formed on the anode. The cathode was clear but slightly darkened. The effect of silica ratio was the same with both the alloy and the sheet zinc.

Effect of Temperature

All of the above tests were carried out at a temperature of 194°F (90°C). Attempts to use higher temperatures led to difficulties. In the first place, it was difficult to transfer the specimen out of the cleaning bath into the rinse without having it dry on the way, when the temperature of the cleaning bath approximated boiling. Rinsing was then much more difficult. In the second place, at the higher temperatures, the clean metal apparently was very reactive and oxidized readily in the air. These difficulties were accentuated with the

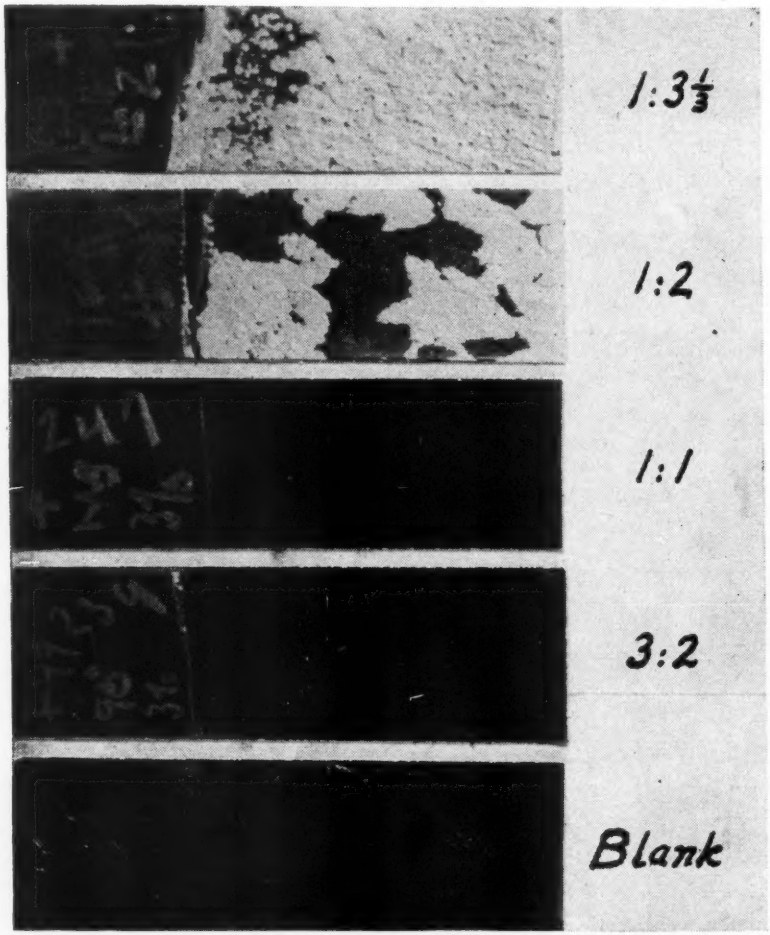

Fig. 2. Effect of silicate ratio on zinc anodes in 3% solutions at 194°F.

thicker alloy electrodes which retained more heat. It is, therefore, recommended that the temperature of the cleaning bath be no higher than 195°F.

At temperatures as low as 140°F (60°C), a 3% 1:1 silicate solution offered no difficulty with the zinc as either anode or cathode. However, at a temperature of 113°F (45°C), a slight deposit formed on the anode. At still lower temperatures, the deposit became heavier, until at 77°F (25°C) the entire surface of the anode was covered with white spots. These results are shown in Fig. 4.

When the concentration of the 1:1 silicate was reduced to 2%, the white spots began to form on the zinc anodes at higher temperatures. Good specular surfaces could be obtained at 176°F (80°C), but at 158°F (70°C) some spots of white material were deposited around the edges and bottom of the zinc anode. At 140°F (60°C), the number of these spots were larger, and a more continuous deposits extended further toward the center of the surface. At 77°F (25°C), a heavy white deposit had formed over most of the anode surface, and the remainder was heavily spotted with white material. This series of anodes are shown in Fig. 5. It would appear from this that a temperature of not less than 175°F or more than 195°F should be used in electrolytic cleaning of zinc where the work is anode. If it is necessary to use lower temperatures, then one should change the concentration of the silicate. With a 5% solution of the 1:1 silicate, anodic cleaning at room temperature can be used safely. On test, the cathodes were specular at all temperatures mentioned above.

The No. XXIII alloy was more sensitive to low temperature cleaning than the pure metal. In 3% 1:1 silicate solutions, a readily discernible deposit formed at 140°F (60°C) but none at 195°F (90°C).

Concentration of Sodium Metasilicate

Most of the experiments which have been discussed so far were carried out with 3% or 4 ounces per gallon. Practical experi-

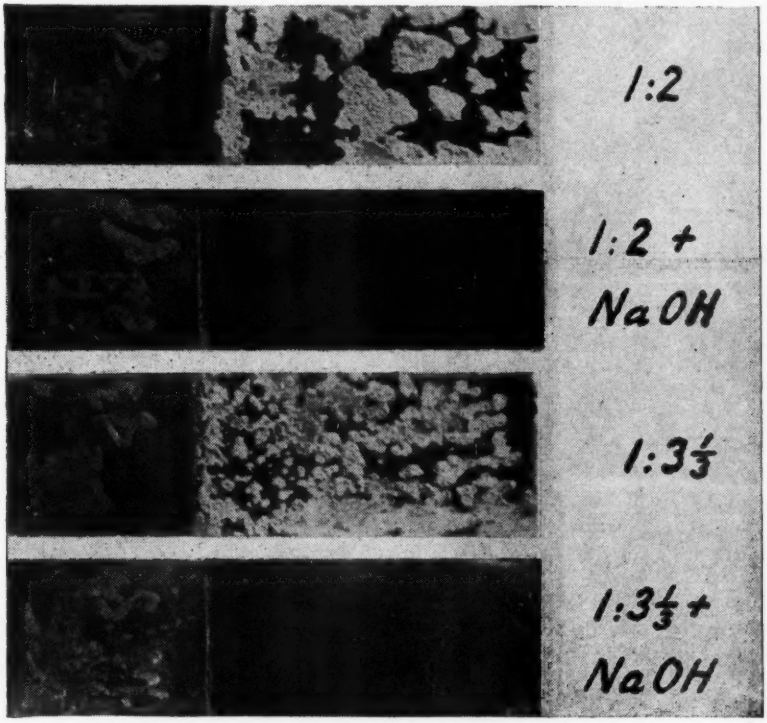

Fig. 3. Effect of caustic additions to dilute solutions of 1:2 and 1:3⅓ silicates at 194°F.

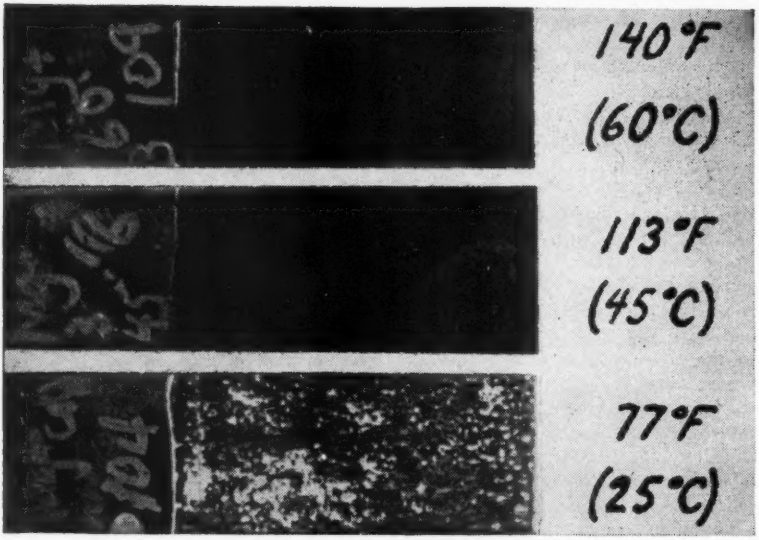

Fig. 4. Effect of temperature on zinc anodes in 3% solutions of 1:1 silicate.

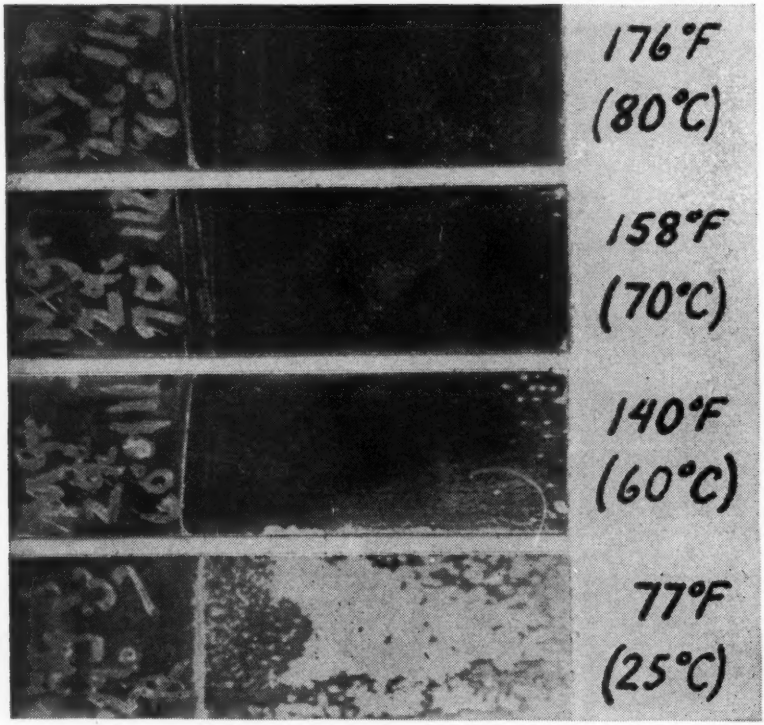

Fig. 5. Effect of temperature on zinc anodes in 2% solutions of 1:1 silicate.

ence had indicated this to be a satisfactory concentration with which to work. These experiments confirmed the fact that the amount was within safe limits, when the above mentioned recommendations regarding temperature were followed. Another series of experiments was undertaken to determine the limits of concentration within which zinc was not attacked. When the metal was cathode, good specular surfaces were obtained with as little as 1% 1:1 silicate and as much as 8%. This would correspond to a range from 1⅓ to 10⅔ ounces per gallon. At a concentration of 0.3% or 0.4 ounces per gallon, cathodically treated zinc became covered with a white deposit. On the high side, at 12% or 16 ounces per gallon, the cathodic zinc exhibited brown streaks. This appearance was typical of excessive alkalinity. The cathodes obtained in 12%, 1.5% and 0.3% solutions are shown in Fig. 7. Cathodes in the solutions of intermediate concentrations had the specular surface of the one in 1.5%. They are not shown in the figure.

When the zinc was anodic (Fig. 6 and 7), there was some darkening of the surface at a concentration of 8% and slightly more at 12%. However, in both instances, the darkening, as will be shown later, was considerably less than with other materials which have been employed in the cleaning of zinc. The anodic specimens were specular at concentrations of 4% and 1.5%.

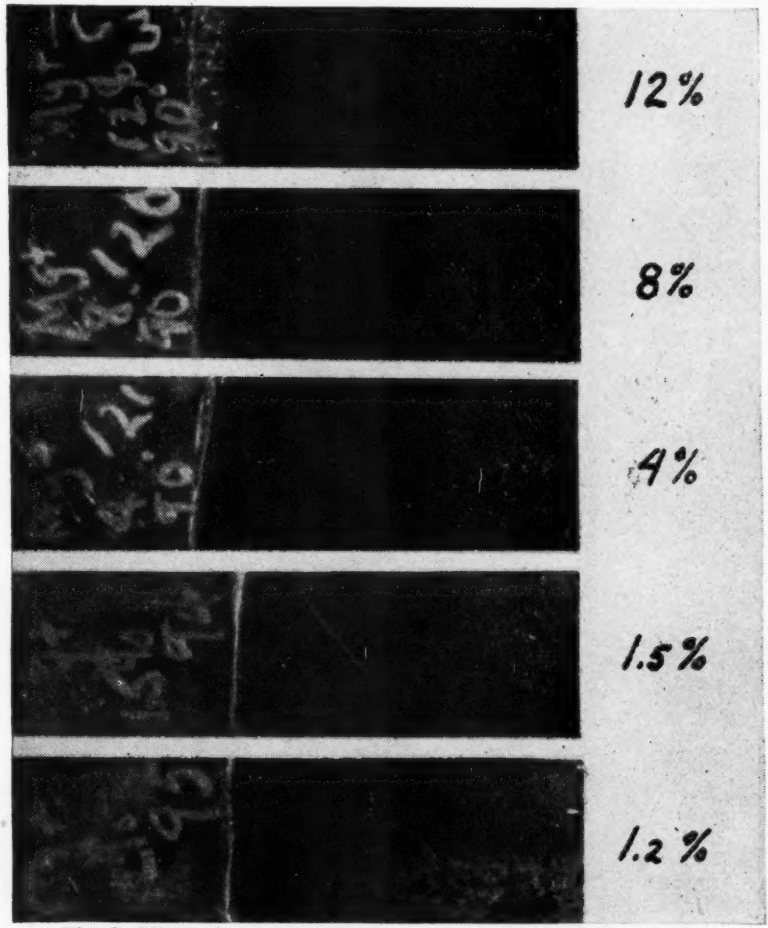

Fig. 6. Effect of concentration in per cent of 1:1 silicate solutions on zinc anodes at 194°F. (Continued in Fig. 7).

When the concentration was further reduced to 1.2%, some white deposit appeared. At 1% the deposit took the form of streaks, and at 0.3% it covered practically the entire surface of the anode. For anodic cleaning, 1.5 to 6% or 2 to 8 ounces per gallon offer a safe range for zinc sheet or galvanized products.

The low limit for anodic cleaning has to be somewhat higher for zinc alloys. In a solution containing 1.5% 1:1 silicate, deposits formed on the alloy when used as anode. A low limit of 3 ounces per gallon is recommended for such cleaning. These limits also are safe for cathodic cleaning, so far as etching, visible deposits, or other forms of attack are concerned.

Concentration of Sodium Sesquisilicate

Sodium sesquisilicate could be used without danger at much lower concentrations than the metasilicate, whether the zinc was cleaned anodically or cathodically. All the cathodes (Fig. 8) had specular surfaces down to and including a concentration of 0.003%. In the photograph the cathode from the 0.003% solution appears whitened, but comparison with the upper untreated portion will show that the sur-

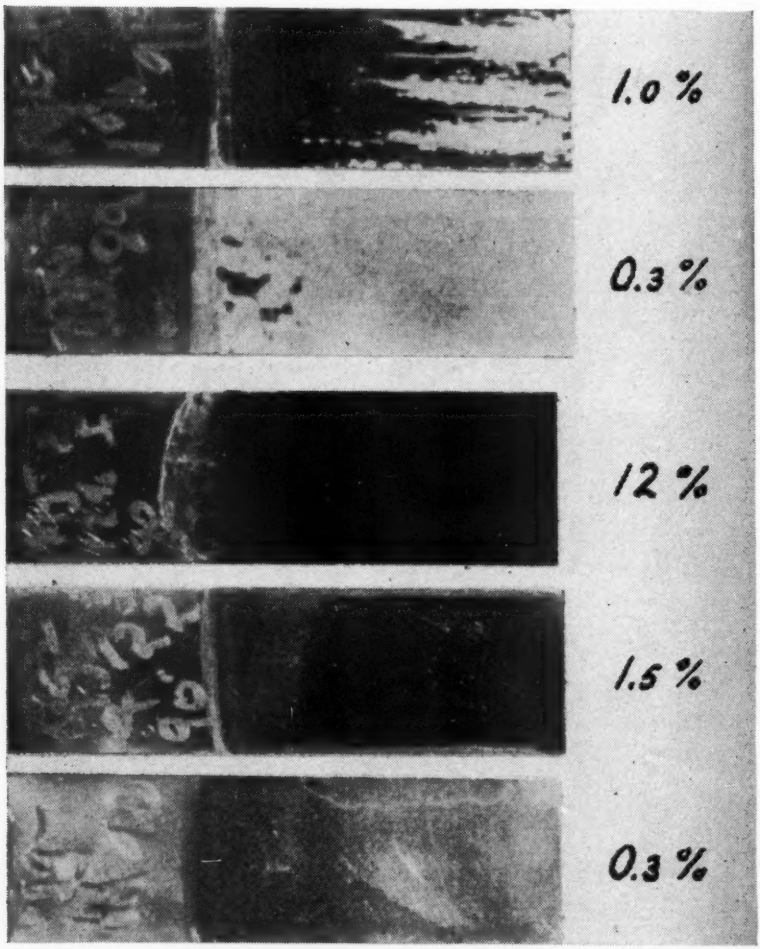

Fig. 7. Effect of concentration in per cent of 1:1 silicate solutions on zinc anodes (two top specimens) and zinc cathodes (three bottom specimens) at 194°F.

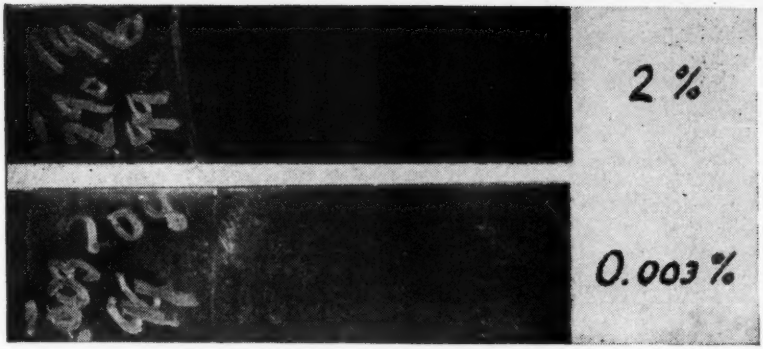

Fig. 8. Effect of concentration in per cent of 3:2 silicate on zinc cathodes at 194°F.

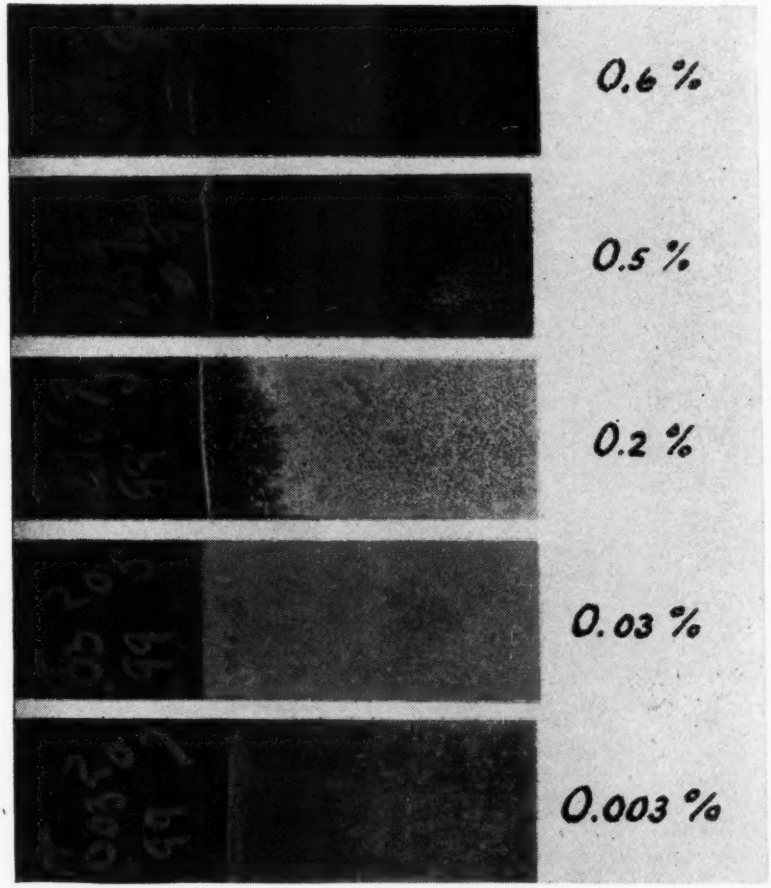

Fig. 9. Effect of concentration in per cent of 3:2 silicate on zinc anodes at 194°F.

face retained its original appearance. It is extremely difficult to photograph a specular surface so as to give the same impression as is given by visual examination.

With the zinc as anode (Fig. 9), a specular surface was obtained in a solution containing 0.6% of the 3:2 silicate. When the concentration was reduced to 0.5%, a number of spots formed on the anode. At 0.2%, almost the entire surface was covered. A further reduction to 0.03% produced a white coating over the entire surface, but the amount formed was not as great as in the case just mentioned. A reduction to one tenth of this concentration, namely to 0.003%, lessened the amount of deposit but did not change the appearance or characteristics.

Water

The formation of a deposit at the low concentration set forth in the last paragraph, raised the question of what would happen if electrolysis were carried out in water alone. It occurred in distilled water as well as in waters containing various amounts of dissolved salts. The amounts of coating formed in a given time was larger in the hard water than in the distilled water, apparently because the electrical resistance was less and the current passing at constant voltage correspondingly larger. These experiments showed very distinctly a certain minimum concentration of cleaning material to be necessary to prevent coating of the zinc by water itself.

Non-silicate Cleaner Compounds

In order to form some idea of how the action of the silicates compared with that of other materials used for cleaning of zinc, a series of tests were run with these materials at 3% concentrations. Caustic soda was used also at 0.6%. The electrodes from this series are shown in Figs. 10 to 13.

The cathode in the trisodium phosphate solution remained specular. The degree of

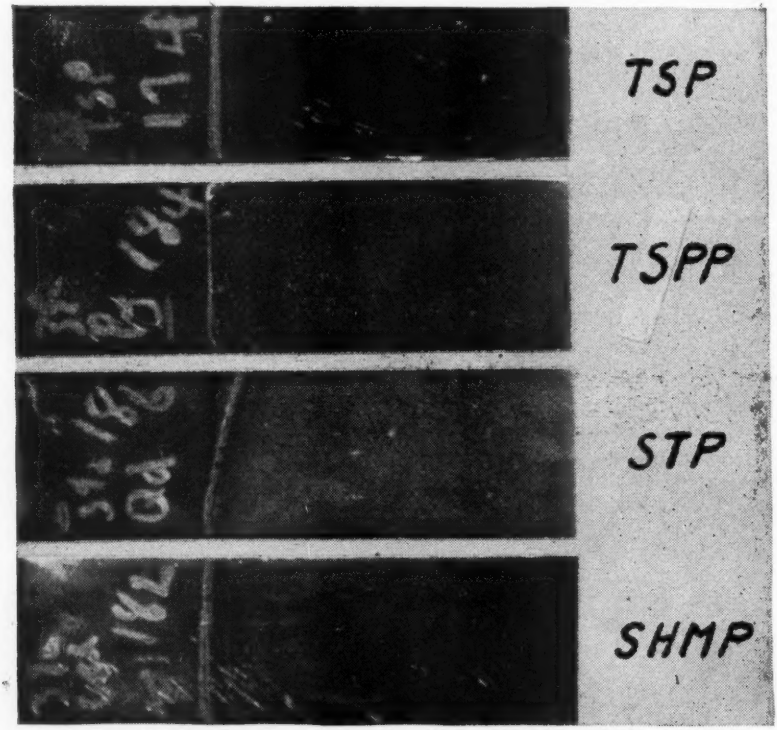

Fig. 10. Effect of 3% solutions of trisodium phosphate (TSP), tetrasodium pyrophosphate (TSPP), sodium tetraphosphate (STP), and sodium hexametaphosphate (SHMP) on zinc cathodes at 194°F.

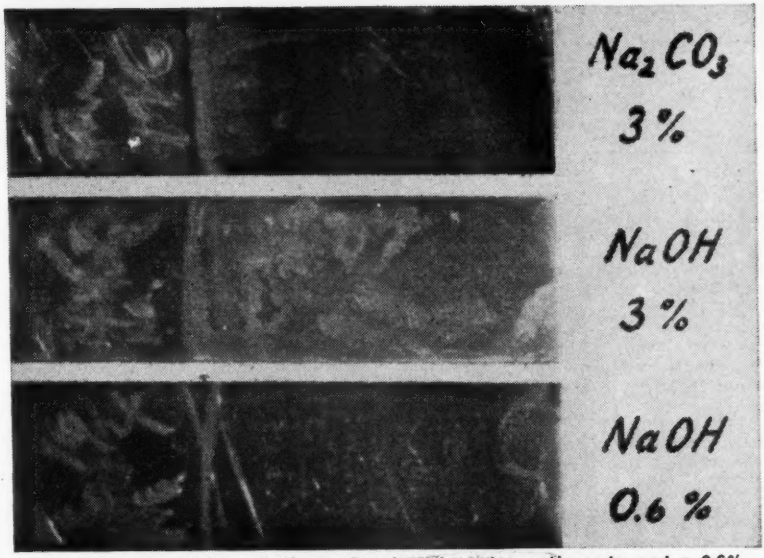

Fig. 11. Effect of 3% solutions of soda ash and caustic soda and a 0.6% solution of caustic soda on zinc cathodes at 194°F.

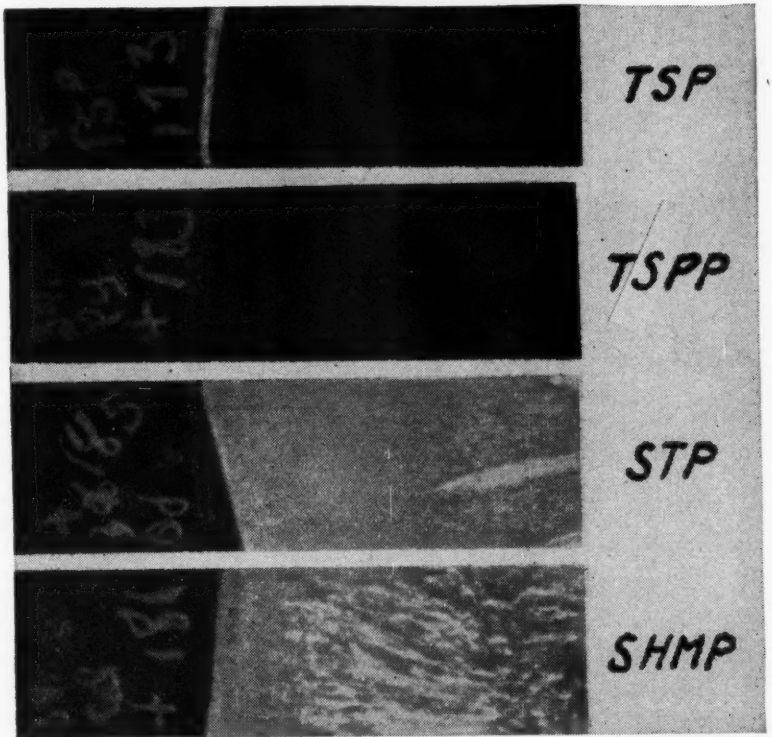

Fig. 12. Effect of 3% solutions of trisodium phosphate (TSP), tetrasodium pyrophosphate (TSPP), sodium tetraphosphate (STP), and sodium hexametaphosphate (SHMP) on zinc anodes at 194°F.

darkening, in spite of the relatively low alkalinity (Table III), was higher than that of the anode in the 12% solution of sodium metasilicate. Tetrasodium pyrophosphate also gave a satisfactory cathode, but the anode was deep velvety black over the entire surface. With sodium tetraphosphate, there was a slight deposit of white material on the cathode while the anode had been generally attacked and was streaked with a white deposit. The cathode with sodium hexametaphosphate was satisfactory, but the anode exhibited general attack and more streaks of white deposit than with sodium tetraphosphate. Generally the cathodes were less attacked than the anodes, but with soda ash this general trend was reversed. The cathode had brown streaks and the anode was bright and specular.

TABLE III

Composition of Alkaline Solutions Used as Electrolytes

Solution	Total Na_2O %	Other Major Constituent %
3.0% Trisodium phosphate	0.77*	0.57 P_2O_5
3.0% Tetrasodium pyrophosphate	0.83†	0.96 P_2O_5
3% Soda ash	1.76	1.24 CO_2
3% Caustic soda	2.32	None
0.6% Caustic soda	0.46	"
3.0% 3:2 silicate	1.11	0.72 SiO_2
1.6% 3:2 silicate	0.59	0.38 SiO_2
3.0% 1:1 silicate	0.89	0.86 SiO_2
3.0% 1:2 silicate	0.83	1.65 SiO_2
3.0% 1:3⅛ silicate	0.58	1.88 SiO_2

*Only 0.53% Na_2O titratable with methyl orange.

†Only 0.42% Na_2O titratable.

Caustic soda at 3% was much too strong. The cathode was etched over its entire surface, while the anode was almost completely covered with a streaky white deposit. When the concentration of caustic soda was reduced to 0.6%, so as to produce a solution of approximately the same pH as that of a 3% metasilicate solution, the cathode was still etched but only in spots. The anode was darkened to a much greater extent that with either metasilicate or sesquisilicate at concentrations as high as 12%.

When the samples of this series were compared to those with sodium metasilicate and sesquisilicate (Figs. 1 and 2), it became evident that at a reasonable concentration, e.g., four ounce per gallon, the silicates were much less likely to produce etching or other forms of attack than other alkaline materials or the polyphosphates.

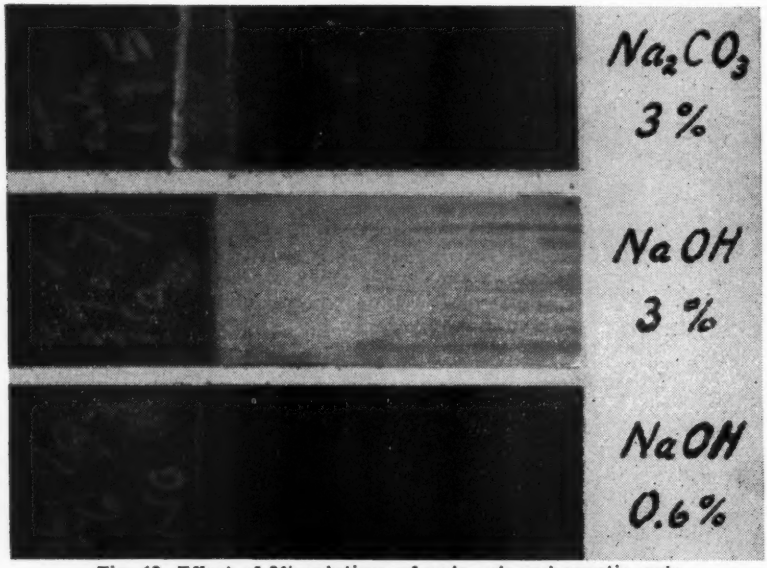

Fig. 13. Effect of 3% solutions of soda ash and caustic soda and a 0.6% solution of caustic soda on zinc anodes at 194°F.

The comparison between the 0.6% caustic soda and the 3% 1:1 silicate is particularly interesting. While the pH of the solutions is approximately the same and the amount of alkali in the metasilicate solution is almost twice as high, the silicate has sufficient inhibiting action to prevent attack at both anode and cathode.

Effect of Water Hardness

Both the 3:2 and the 1:1 silicates in recommended concentrations give precipitates when dissolved in waters of a wide range of hardness. There was no evidence that the reactions caused any change in the effect on the zinc, although, of course, small amounts of the silicates would be used up in the process. The material which precipitated was not deposited on either electrode. So far as silicates are concerned, it did not appear to make any particular difference whether the cleaning bath was prepared with hard or soft water. However, when hard water was used for subsequent rinsing, there was considerable danger of having films of the material dissolved in the water left on the surface of the work. For final rinsing, softened, or better distilled or deionized water would appear to be very helpful.

Effect of Current Density

Solutions containing 3% 1:1 silicate were subjected to electrolysis at current densities of 2, 2.5, 3, 4, 5 and 10 amperes per square decimeter (19, 23, 28, 37, 47 and 93 amperes per square foot). None of these seemed to have any deleterious effect on the cathodes. However, an increase in current density increased the tendency toward deposition on the anodes. At 4 amperes per square decimeter (37 amperes per square foot) a few white spots formed on the extreme edge of the specimen and the entire surface was slightly darkened. At 5 amperes per square decimeter (46.5 amperes per square foot) there were more spots on the edges and near the bottom of the strip. At 10 amperes per square decimeter (93 amperes per square foot) the anode was severely attacked. The entire surface turned white and became streaked. The resistance of the cell increased so rapidly that the current dropped to 6 amperes per square decimeter (55.7 amperes per square foot) after five minutes.

Increased concentrations of 1:1 silicate reduced the attack on the anodes without affecting the cathodes. Even at 10 amperes per square decimeter in a 4% solution the anode had only a few short thin white streaks against a white background. The anode in a 12% solution was black when wet and showed a little white mottling when it was dry. It looked considerably better than the anode obtained at this concentration with a current density of one ampere per square decimeter.

Still higher current densities were tried with a 3% solution of 3:2 silicate: 10, 12, 16 and 20 amperes per square decimeter (93, 112, 149 and 186 amperes per square foot). The anode at 10 amperes per decimeter was quite dark; with increasing current densities they became lighter. The 20 ampere per square decimeter anode was silvery white. There were no deposits.

A solution containing 1.6% 3:2 silicate was prepared so it would have approximately the same pH as a 3% 1:1 silicate solution. Three current densities were used: 3, 4 and 8 amperes per square decimeter (28, 37 and 74 amperes per square foot). The anodes were similar in appearance to those electrolyzed in 3% 1:1 silicate solutions. The 8 ampere per square decimeter anode had a few white streaks near the bottom. The cathodes from these experiments were exceptionally good. This was not due to the electrolytic treatment, but to a change in the method of rinsing. The new method consisted in chilling the zinc removed from the electrolytic bath by rinsing in cold water. The cathodes were specular and appeared to have polished surfaces. It was found that with the cold rinse there was less danger of the formation of a slight white mottling, which was thought to be caused by the formation of zinc oxide on the cleaned metal surface.

Electrical Resistance

Many of the experiments described previously in this paper were conducted at current densities of one ampere per square decimeter. The applied voltage was regulated so as to maintain the current at approximately the desired value. Since the areas of the electrodes were the same and the cell arrangement was the same in every

case, a fair idea of the resistance of the various solutions used can be obtained. The voltage drop across the cell was divided by the amperage to determine the overall "resistance" in ohms.

Reproducibility

In order to give an idea of the degree of reproducibility, duplicate experiments were run at different times with different solutions and different electrodes but at 90° ± 2°C and approximately one ampere per square decimeter have been collected in Table IV. The readings were taken at

TABLE IV

Reproducibility of "Resistivity" Tests

Time Min.	Test A			Test B		
	Amp.	Volt	"Ohm"	Amp.	Volt	"Ohm"
3% 1:1 Silicate						
1	0.255	4.1	16.1	0.248	4.0	16.1
2	0.251	4.2	16.7	0.245	4.2	17.1
3	0.250	4.3	17.2	0.242	4.5	18.6
4	0.249	4.5	18.1	0.241	4.3	17.8
5	0.248	4.6	18.55	0.240	4.3	17.9
3% 1:2 Silicate						
1	0.255	4.0	15.7	0.250	4.0	16.0
2	0.245	4.8	19.6	0.240	4.8	20.0
3	0.240	5.0	20.8	0.225	5.05	22.4
4	0.231	5.0	21.65	0.220	5.5	25.0
5	0.231	5.0	21.65	0.220	5.5	25.0

one minute intervals after starting the cell. The differences in the later readings on the 1:2 silicate probably were caused by different amounts of the white deposit present on the anodes.

Effect of Silicate Ratio

By comparing at one minute intervals the "resistance" of the cells containing 3% solutions of the various silicates, some idea of the relative "conductivity" can be obtained. It must be remembered that these figures are based on 3% solutions of the commercial materials, and, therefore, have not been corrected for differences in either alkali or total solids contents (Table III). These data are given in Table V.

In spite of the varying amounts of sodium oxide and silica, the "resistance" of all the cells after the current had flowed one minute was very similar. With 1:2 and 1:3⅓ silicates the initial "resistance" was low but rose rapidly as deposits formed on the anodes. The increase was much less rapid with the other two silicates, which formed no deposits.

TABLE V

"Ohmic Resistance" of Cells with Zinc Electrodes in Silicate Solutions

All solutions 3% by weight

Time min.	3:2 silicate	1:1 silicate	1:2 silicate	1:3⅓ silicate
1	16.1	16.2	16.0	14.6
2	16.7	16.9	20.0	22.8
3	17.2	18.5	22.4	24.1
4	18.1	19.3	25.0	29.0
5	18.6	20.0	25.0	31.6

Non-silicate Solutions

Comparable "resistance" figures for cells with solutions of other materials are given in Table VI. As would be expected,

TABLE VI

"Ohmic Resistance" of Cells with Zinc Electrodes in Non-silicate Solutions

Time Min.	Caustic Soda 3%	Caustic Soda 0.6%	Trisodium Phosphate 3%	Soda Ash 3%
1	3.1	20.0	20.0	20.6
2	3.5	20.1	20.55	21.25
3	4.0	20.75	21.6	24.25
4	4.0	20.9	22.6	25.55
5	4.0	21.7	23.3	25.65

the "resistance" of a 3% caustic soda solution was very much lower than those of 3% solutions of the other materials, not only on account of the very high Na_2O content (2.32%) but because of the high transport number of the hydroxyl ions present in large quantities. The 0.6% solution of caustic soda, which presumably had the same hydroxyl ion content as a 3% solution of 1:1 silicate, had a considerably higher "resistance". However, the caustic solution contained only a little over half as much sodium oxide and no silica. The results of all these experiments indicate that the silica was in a form which carried a considerable amount of the current. The "resistance" of the trisodium phosphate cell was relatively high. The "resistance" of the soda ash solution was high and increased with time. This was surprising because the amount of alkali was high (1.76% Na_2O) and there was no

visible deposit from this solution on the zinc. There did seem to be some oxidation of cathode, but even this could not have been considerable.

The relative "conductivities" in reciprocal ohms of all these alkalies, except the more concentrated caustic soda, have been plotted in Fig. 14.

RECOMMENDATIONS

The following suggestions which are based on the experiments reported here as well as on other observations, will aid in the cleaning of zinc and zinc alloys.

When the metal is made cathode (direct cleaning), good results may be obtained over a much wider range of concentration, temperature and current density than when it is made anode (reverse cleaning). Much less attention and control are needed. However, frequently a very short interval of anodic cleaning is found desirable after cathodic cleaning. Therefore, the conditions for anodic cleaning should be maintained.

At temperatures of 175°-195°F, a bath containing 4 ounces of sodium metasilicate per gallon will not form deposits or attack the metal. With sodium sesquisilicate the

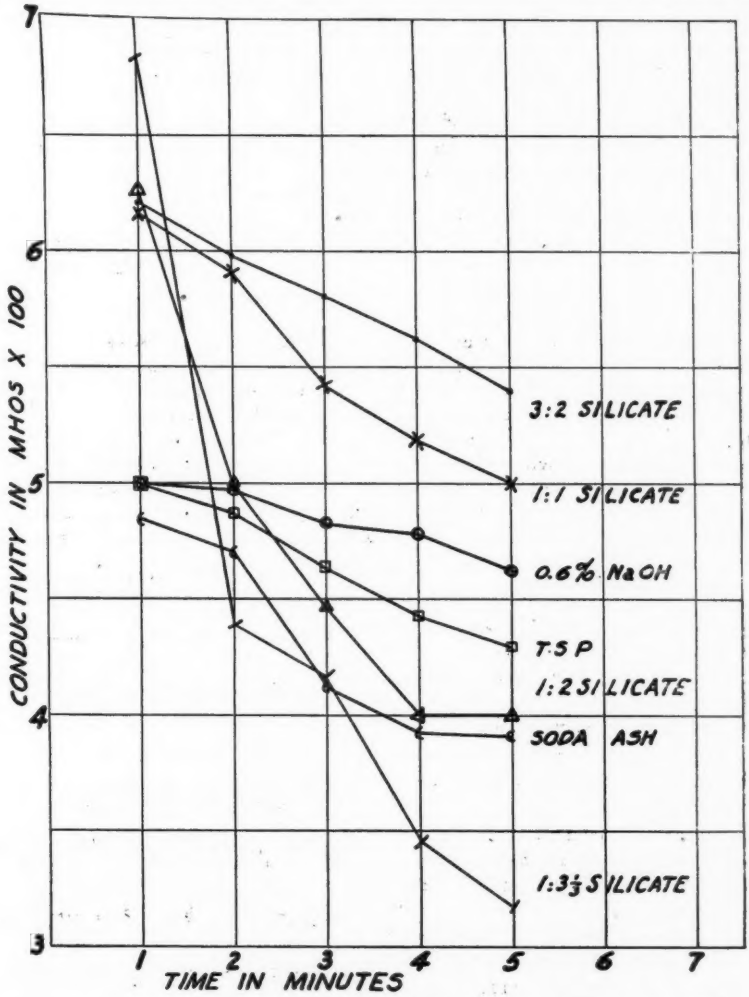

Fig. 14. Variation of "conductivities" of 3% solutions (except of caustic soda) between zinc electrodes with time.

concentration can be reduced to as little as one ounce per gallon. If it is difficult to maintain a high temperature or if the soil is of a type which is more readily removed at about 160°F, the initial concentration of the bath should be one ounce per gallon higher than the values recommended above. Additions to the bath should be made so as to maintain the initial concentration at plus or minus one ounce. The values suggested have been chosen to provide good cleaning, to minimize losses dues to drag-out, to insure good conductivity, and to give a a bath that does not need too frequent replenishment.

A current density at full load of not over ten amperes per square foot is desirable. Five to ten amperes per square foot should be sufficient to lift dirt rapidly and yet to minimize the chances for difficulties when the tank is underloaded. Higher current densities are feasible with cathodic cleaning.

It is desirable to have contact made so the current will start flowing as soon as the article is immersed. If this is not possible, the period between immersion and application of current should be short.

The interval between washing and rinsing also should be reduced to a minimum. Zinc readily oxidizes in air when it is clean and hot. The recommended silicates rinse so easily that cool or cold water will remove them quickly and reduce the chance of oxide films forming, especially on large parts. Water low in dissolved solids is desirable for rinsing.

CONCLUSIONS

1. At 195°F and a current density of approximately 1 ampere per square decimeter, zinc or zinc casting alloys can be cleaned anodically in 3% solutions of sodium metasilicate or sesquisilicate.

2. Under the same conditions the sodium di- and "tri"-silicates give heavy white deposits on the anode.

3. The formation of anode deposits is not dependent on the silica content but on the $Na_2O:SiO_2$ ratio in the silicates employed.

4. There are no deposit or attack on zinc or zinc alloy cathodes with the silicates alone under any of the above conditions.

5. Lower temperatures or lower concentrations increase the probability for the formation of anodic deposits.

6. Higher concentrations of sodium metasilicate cause brown streaks on the cathodes at 9% and darken the anodes slightly at 8 and 12%.

7. A definite minimum concentration of each chemical is required to prevent the formation of anodic coatings on zinc.

8. Three per cent solutions of sodium metasilicate, sesquisilicate or sodium carbonate can be used safely for anodic cleaning; the same concentration of the same silicates and of trisodium phosphate, tetrasodium pyrophosphate and sodium metaphosphate are safe for cathodic cleaning.

9. It is unnecessary to use soft water in the preparation of silicate cleaning baths.

10. Rinse water should be as free from dissolved solids as possible.

11. Higher current densities increase the tendency for deposits to form on the anodes.

12. The conductivities of 3 per cent sesquisilicate and metasilicate solutions are high as compared with those of other materials except sodium hydroxide.

13. The electrical resistance rises rapidly when deposits form on the electrodes.

The question which led to this work being undertaken seems to have been answered. Not only can sodium silicates be used in cleaning zinc and zinc alloys but, when correctly selected silicates are used under the conditions indicated, both attack and deposit on the metals are eliminated.

REFERENCE

[1]C. L. Baker: Ind. Eng. Chem. **27**, 1358-64 (1935).

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Electroplating at
A. S. T. M. SPRING MEETING

THOSE of our readers who read the By-Laws of the Research Committee which appeared in the March issue, will have noticed that intimate cooperation with Committee B-8 on Electrodeposited Metallic Coatings of the American Society of Testing Materials is an important part of Research Committee policy.

The two Committees do not duplicate activities but complement each other. The A.E.S. Research Committee may be called a fact-finding group which devotes its efforts to correlation of accumulated knowledge and to the development of new knowledge. Committee B-8, like all A.S.T.M. Committees, has for its primary function the writing of specifications. Only when necessary data are not available does B-8 attempt their development; however, it confines such activities to study of behavior of plated coatings in service and to evaluation and standardization of quality tests.

The very close relation between the two committees was clearly demonstrated at the A.S.T.M. Meeting held in Pittsburgh, February 25 to March 1. A considerable number of the members of the Research Committee and its Sub-Committee also function in Committee B-8 and took active part in the meetings.

Great satisfaction was expressed with the progress being made by the A.E.S. Research Committee, especially during the meeting of Sub-Committee III on Conformance Tests. This meeting was largely devoted to a review of A.E.S. Research Projects No. 3 on "Methods for Testing Adhesion", No. 6 on "The Nature and Effect of Porosity in Electrodeposits", and No. 7 on "Methods for Testing Thickness of Electrodeposits". The hope was expressed that these projects would lead to development of tests which could be so standardized that they would be generally applicable and meet the urgent need of the industry. Mr. E. A. Anderson was chosen Chairman of this Sub-Committee to serve during the remainder of the term of Mr. C. H. Sample who had to retire for lack of time.

Sub-Committee II on Performance Tests reviewed the results of its outdoor exposure tests on lead coatings which, under the Chairmanship of Dr. H. A. Pray of Battelle Memorial Institute have been in progress for about two years, at New York City, State College, Pa., Kure Beach, N. C. and Tela, Honduras. Except for rust stains and pin holes, the 0.0005 inch and thicker coatings are generally still in good condition. Preliminary specimens for study of the effect of copper thickness and other variables in copper-nickel-chromium coatings are in the process of being exposed.

Sub-Committee IV, under the Chairmanship of A.E.S. Executive Secretary, Dr. A. K. Graham, decided to write a Recommended Practice Specification for the Preparation of High Carbon Steel (Other Than Alloy Steel) for Electroplating. Other similar projects were discussed.

Sub-Committee V on "Supplementary Protective Finishes for Metallic Coatings" agreed to start a study of chromate and phosphate type coatings on zinc and cadmium. These studies will involve outdoor exposure tests as well as accelerated tests including the salt spray test and humidity test.

At the meeting of the main Committee B-8, Dr. R. J. McKay and Mr. C. H. Sample were re-nominated for Chairman and Secretary, respectively. Mr. Gustaf Soderberg was nominated for Vice-Chairman on the resignation of Mr. E. A. Anderson, who has held this post since the organization of the Committee in 1941 and whose judicious advice has been most helpful during its formative years.

Another Committee on which many A.E.S. members are active, is Committee B-3 on Corrosion of Non-Ferrous Metals. Of particular interest is the work carried out by its Sub-Committee III under the Chairmanship of C. E. Heussner, Chairman of the A.E.S. Research Committee. This Sub-Committee held a most interesting meeting which reviewed recent findings pertaining to control of conditions in the salt

(*Continued on page* 398)

CLEANING AND CORROSION TIPS

Issue No. 1

May • Published Monthly in the Interest of Advancing Metal Cleaning Progress 1946

TODAY, MORE THAN EVER, industry's profits depend upon improved plant performance and reduced plant production costs. Costs, perhaps secondary to increased production during the war, must now be examined in minute detail. Each process—even those which apparently function efficiently—must be checked for further improvement. It is our aim to aid the metal cleaning departments in American industry in producing better cleaned products at a faster rate and at *lower cost.*

W. P. Drake
Manager of Sales, Pennsylvania Salt Mfg. Company

CASE NO. 401

Brass Company Saves $170 A Month in One Operation

Removing Buffing Compound Without Discoloration Was the Big Problem

A well-known brass company was busy turning out spigots and other plumbing fixtures. Rejects were numerous since cleaners strong enough to remove the buffing compound from the brass prior to chrome plating had a tendency to discolor the metal.

After studying the problem, a Pennsalt man with his technical experience suggested one of the Pennsalt Cleaners, which not only met the exacting requirements of the job, but actually saved on an average of $170 a month on the cleaning operation.

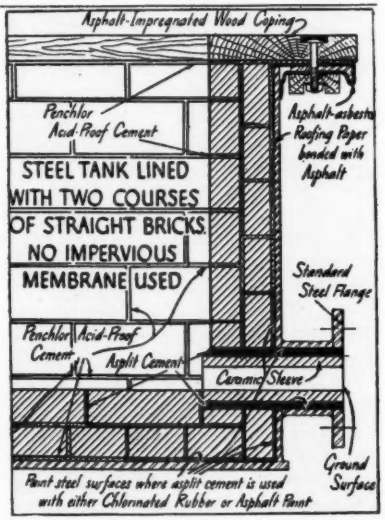
CASE NO. 455

One Cleaning Process Replaces Three

Furniture Maker Finds Slow, Costly Hand Operations Unnecessary

Prior to electrolytic cleaning, tube frames in this factory were first given a sawdust cleaning followed by an actual hand-scrubbing operation.

A Pennsalt Cleaner, adopted on the recommendation of a Pennsalt man, with his knowledge of advanced metal cleaning, now cleans the tubing thoroughly in one operation and prepares the surface properly for the exacting chrome plating operations. Costly hand operations are out, production costs are down.


Asphalt-Impregnated Wood Coping
Penchlor Acid-Proof Cement
Asphalt-asbestos Roofing Paper bonded with Asphalt
STEEL TANK LINED WITH TWO COURSES OF STRAIGHT BRICKS. NO IMPERVIOUS MEMBRANE USED
Standard Steel Flange
Penchlor Acid-Proof Cement
Asplit Cement
Ceramic Sleeve
Ground Surface
Paint steel surfaces where asplit cement is used with either Chlorinated Rubber or Asphalt Paint

Cross-section view of a pickling tank in a large steel mill. Penn Salt's Penchlor Acid-Proof Cement and Asplit Cement used in its construction.

CASE NO. 425

Cleaning 3 Metals at Once Cuts Cost 20% for Silverware Maker

In cleaning stainless steel, britannia metal and brass pieces, this manufacturer had found it necessary to use a different cleaner for each metal. The Pennsalt man suggested a cleaner which now cleans all three metals in the same solution at one time in both electrolytic and still tank operations—and slices cleaning costs 20%.

CASE NO. 451

Pre-Cleaning Eliminated on Adding Machine Parts

Guided by the precision demands of such parts as springs, bearings, and key arms, an adding machine corporation had been using a laborious pre-cleaning operation prior to electrolytic cleaning. A recent survey of the setup by the Pennsalt man resulted in the adoption of a certain Pennsalt Cleaner. The pre-cleaning operation was eliminated entirely and over-all cleaning costs were reduced about 60%.

CASE NO. 475

Electrical Products Metal Cleaning Costs Down 28%

Use Same Cleaner Before Plating or Enameling

A maker of electrical products had experimented with many different makes of cleaners, trying to get junction boxes of low carbon steel really clean. Finally, he was forced to use one cleaner for those boxes to be enameled and another for those to be plated.

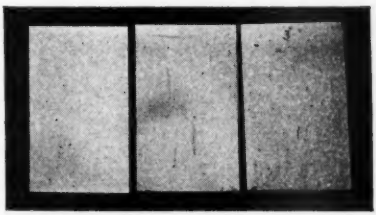
When the Pennsalt man was called in, he studied the problem and then, with his practical knowledge of cleaning methods, suggested a single Pennsalt Cleaner which is now cleaning both types of junction boxes thoroughly (for the first time) and actually cutting cleaning costs 28%.

ADVANCED METAL CLEANING

PENN SALT

THE LAB NOTE BOOK

Ultra Violet Light Aids in Testing Metal Cleaners



In testing the effectiveness of metal cleaners it is always necessary to know when the surface is clean. The use of ultra violet light immediately reveals unremoved soil (oils and greases) as shown by the above picture taken under ultra violet light. These tests were made at the Whitemarsh Research Laboratories.

YOU NEVER CAN TELL

Take the case of the production manager for one of the nation's largest automobile manufacturers. He was glad to see the Pennsalt man the morning he called. Not because the production manager had a problem. On the contrary, he was anxious to show the Pennsalt man, who had never visited this plant before, the efficiency of his cleaning setup.

As the two of them watched the cleaning operations, one question led to another; the Pennsalt man told the production manager the latest developments in advanced metal cleaning, and the plant's cleaning operations developed an entirely new aspect. Thinking along these lines, new cleaning ideas crystallized, until shortly, the production manager knew how the seemingly efficient cleaning operation could be materially improved.

As a result of this exchange of ideas, this automobile company's metal cleaning is now being done by a new method and with a Pennsalt Cleaner. Now as much cleaning is done in 320 man-hours as formerly required 3,000 man-hours.

THE POINT IS: No matter how efficient your cleaning operations are, the Pennsalt man may be able to help you turn out *better work . . . faster . . .* at a *lower production* cost.

If you would like to see the Pennsalt man, write to Dept. MR. If your problem is urgent—wire, and he will call immediately.

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Copper-Tin ALLOY PLATING

By CLIFFORD STRUYK

The author, now with the General Chemical Company, Edgewater, N. J., was during the war connected with the Wright Aeronautical Corporation, Paterson, N. J. In this article he describes his experiences with true bronze plating for stop-off against nitriding, and suggests peace-time uses of electro-deposited bronze coating for decorative purposes.

Tin as Nitriding Stop-Off

TIN was widely used prior to the war to prevent nitriding of core areas on parts. It has one great weakness. Nitriding is usually accomplished by holding the parts to be surface hardened in an atmosphere of dissociated ammonia at temperatures of 950°F to 1000°F for time periods of from 25 to 75 hours. Tin of a minimum thickness of 0.0002 in. prevents the nitrogen, which combines with iron, chromium and aluminum to form nitrides, from reaching the surface. Since tin melts at temperatures well below the nitriding temperature, it would run off were it not for the interfacial tension which holds up to 0.0005 in. of tin on the surface of the steel. The usual procedure was, therefore, to apply between 0.0002 and 0.0005 in. of tin. However, in spite of the excellent throwing power of sodium stannate solutions, it was not always possible to meet the minimum thickness requirement in the recesses of intricate parts, without exceeding the maximum on protruding portions. The excess of tin on one part would then run off and would cover or spatter surfaces of other parts which were left free from tin. Soft areas or spots would result where not desired. Damage could sometimes be avoided by careful stacking of the parts, but even when successful, stacking was troublesome.

Tin-Bronze as Nitriding Stop-Off

The extensive use of bronze plating in the manufacture of Wright aircraft engines was begun because of the shortage of tin, the largest tin producing areas of the world being occupied by the Japanese. It became evident early in the war that tin would be one of the most critical metals, and since considerable quantities of tin were being deposited from sodium stannate solutions to stop-off nitriding from core areas of gears, shafts and kindred parts, research was instituted to find a substitute for tin in this application. The critical nature of the stop-off made the task a difficult one. Cost limited the choice of the protecting medium. Yet, it was necessary to find a stop-off that would have an efficacy fairly close to 100%. If penetration occurred during the nitriding cycle, the areas which had to be protected would have cased portions which would lower the strength of the parts. This was especially serious in the case of web areas of gears, where the thinness of the section made it imperative that the area be kept free of all nitriding. Even spots of nitride penetration were not permissible since these hard spots, if large enough, might cause cutting tools to break. If the areas were ground, the hard spots very often could cause grinding checks which would form nuclei for fatigue cracks during service. Therefore, all parts were examined after nitriding for penetration through the protective coating on the core areas. This inspection was often by hardness test, but in some instances included macro-etching.

Nickel was reported in the Metals Handbook as being used successfully but could not be considered a substitute for tin as it was, if anything, more critical than tin.

Approximately forty metals and combinations of metals were tested. It was found that a layer of copper with a thin tin overlay would do a satisfactory job. The chemists at the Lockland plant then decided to test the simultaneous deposition of copper and tin. The first effort was made by combining a high concentration copper cyanide bath with a sodium stannate solution. The deposits obtained were of yellow bronze color and, when tested as ni-

triding stop-off, were found to be entirely satisfactory. A production trial indicated the behavior of the bath and the bronze deposit to be satisfactory and in a short time bronze had almost entirely replaced tin as a nitriding stop-off. Since tin-bronze is harder than tin, failure caused by abrasion during shop handling was eliminated, as well as other difficulties.

A Literature Search

In a search for information on the electrodeposition of copper-tin bronzes, to supplement the data collected in plating this alloy, little published data was found. In fact, most references to bronze plating did not refer to a true tin-copper bronze but rather to a brass of high copper content. Blum and Hogaboom, in their book on electroplating, state: "The bronze plating now commonly applied to hardware and similar articles is not a true bronze, i.e. an alloy of copper and tin, but is brass with a high copper content, e.g. 90 to 95% copper." This observation of about fifteen years ago still holds to a substantial degree.

One of the early methods of copper-tin bronze plating is disclosed in a British patent granted to Leech and Hammond in 1928. In 1934 a British patent was granted to Cowper-Coles for the plating of copper-zinc and copper-tin-zinc alloys. In this method, the plating solution was diverted into separate streams for separate regeneration of each of the metal constituents. The regenerated streams were returned to the plating cell in which lead or iron-silicon were used as anodes.

Charles Bechard in 1935 described a similar arrangement in a French publication, in which a carbon anode was used in the plating cell. The replenishment of the solution was accomplished in separate streams, using tin anodes in one stream and copper anodes in another. The cathodes in the auxiliary systems were enclosed in a porous vessel containing acid. Hence hydrogen was liberated at the cathode while the metal dissolved from the anodes. The regenerated streams were then fed into the main plating cell. The plating solutions described were of two types, namely ammonium copper oxalate — ammonium tin oxalate and potassium stannate — potassium copper cyanide. An acid bath containing oxalates was described by Charles Bechard in 1936 (J. Electrodepositors' Tech. Soc.).

In 1936, S. Baier and D. J. Macnaughtan discussed (J. Electrodepositors' Tech. Soc.) a sodium stannate-sodium copper cyanide plating solution, maintained at 65°C, in which annealed cast bronze anodes were used. The copper-tin ratio in the solution was about 3.5 times that in the deposit. The authors stated that the deposits were pore free when not less than 0.0003 in. thick, and that they were suitable for use as undercoatings for chromium.

A patent was granted to Batten and Welcome in 1934 on the electrodeposition of bronze from a solution similar to that described above. The methods used at the Wright Aeronautical Corporation and described in this paper, were similar.

The Plating Cycle

The method of cleaning the parts for bronze plating followed the steps usually taken for cleaning prior to tin plating. The following cycle has proven very satisfactory and, if slightly long, erred in the interest of good plating.

1. Vapor degrease — usually in baskets
2. Rack
3. Insulate if necessary
4. Anodic clean in hot caustic cleaner
5. Hot water rinse
6. Bullard-Dunn acid treatment
7. Warm water rinse
8. Anodic clean in hot caustic cleaner
9. Warm water rinse
10. Cold water rinse
11. Acid dip — usually in 15% muriatic acid by volume
12. Cold water rinse
13. Dip in dilute sodium cyanide solution
14. Cold water rinse
15. Bronze plate to 0.00035 in. minimum thickness as determined by the Magne-Gage
16. Cold water rinse
17. Hot water rinse
18. Blow dry
19. Inspect coating for thickness and continuity

The Plating Bath

The solution was formulated as follows:

Sodium stannate	5.0	oz/gal
Copper cyanide	4.75	"
Sodium cyanide	7.25	"
Sodium hydroxide	1.50	"

The bath was maintained at a temperature of 145° to 155°F by means of a steel steam coil suspended along the sides of the tank near its bottom. The temperature was controlled by means of pressure actuated valves. Plating was usually done at a cathode current density of 15 to 25 amp/sq.ft. In a few special installations in which vigorous agitation and continuous filtration were employed, it was possible to plate at as high as 100 amp/sq.ft. Agitation of the work or of the solution was necessary to obtain good sound bronze deposits. The work was usually agitated by means of moving cathode rails on still tanks or by rotation with transverse movement on full automatic equipment. In some installations the solution was agitated by pumps or by motor driven impellers or agitators. Deposits plated from unagitated solutions tended to be dull, streaked and even spongy in extreme cases.

Anode Corrosion

The success of the bronze plating from the cyanide-stannate solution depended to a very large extent on the control of the anode corrosion. It is well known that the corrosion of anodes in an alkaline tin bath must be critically controlled for the production of sound deposits. In like manner, the tin anode corrosion must be controlled in the bronze plating solution. It was found early that good anode corrosion was not obtained if the copper and tin anodes were hung from the same anode rail in the same proportion as the copper-tin ratio in the deposit. Tin dissolved from the anode in the form of stannous tin which caused black spongy deposits to form. Copper deposited on the tin anode. The answer to this problem was found in the use of dual anode circuits. In the usual installation, the tin anode rail was placed along one side of the tank and the copper anode rail along the other. Each anode rail was then connected to the positive bus bar through a separate tank rheostat. The cathode rail was connected to the negative bus bar. A current density meter was hung from the cathode rail. The usual method was to fill the copper anode rail with copper anodes in the form of balls in baskets or copper slabs. A few tin anodes of like form were hung from the tin anode rail. Work was placed in the tank, and the current was adjusted by means of the tank rheostats on each circuit. Anodes were then added or removed until the tank voltage in the copper circuit was between 3 and 3.5 volts and the voltage in the tin circuit was between 4.5 and 5 volts. Voltages of this magnitude produced the desired anode corrosion for simple solution maintenance. Although the method sounds cumbersome, it worked quite satisfactorily once it was established. The work loads were usually quite similar, and the operators, after they had gained knowledge of the process, could judge the proper amount of anode necessary at a glance. In addition, the wide operating ranges of the bath made it unnecessary to vary anode areas from load to load, and the anode area was changed only when there were drastic changes in the cathode area.

Alloy Anodes

Since the use of alloy anodes would have simplified the manipulation of the process, it was investigated. It was found that good corrosion of the alloy anodes could not be obtained. Several different heat treatments of the alloy anodes were tried unsuccessfully, usually because of formation of a black adherent film on the anode during use. The difficulty in obtaining good corrosion of alloy anodes in cyanide-stannate baths has been attributed by Faust in Modern Electroplating to low solubility of intermetallic compounds of copper and tin. Heat treatment of anodes, which is usually designed to improve anode solubility by dispersing impurities from grain boundaries into the grain, would not necessarily aid the solubility of the intermetallic compounds. In view of this, the original choice of a dual anode system was considered a happy one and was continued.

However, a recent study of the copper-tin alloy equilibrium diagram, shown in Fig. 1, indicated a good probability that suitable heat treatment would permit an anode to be produced that would corrode properly in the alkaline bronze bath. Further investigation of the alloy anode apparently is warranted. The bronze anode should be heat treated so as to have the copper and tin in a solid solution. The solid solution is indicated in the diagram as alpha. The upper limit of solubility for tin is about 16% and above this the alloy contains

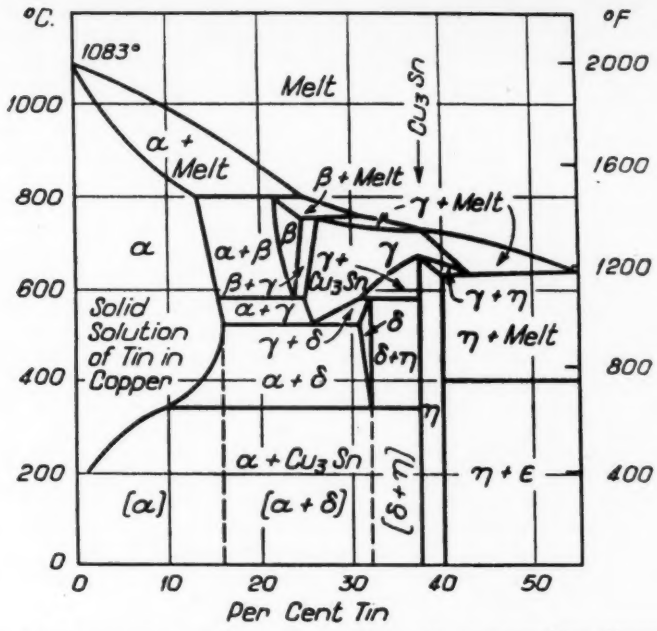

Fig. 1—Copper-rich portion of the copper-tin constitution diagram.

an intermetallic compound, the composition of which is believed to be $Cu_{31}Sn_8$. Unfortunately, the figure of 16% is based on a true equilibrium, whereas in a chilled casting the limit of solubility is about 5% and in a slowly cooled alloy about 10%. This points the direction of the investigation. One approach would be to heat an alloy of 10 to 15% tin to 1200-1300°F, hold it at heat for a considerable time and then cool it slowly. Because of the enormous grain growth during this heat treatment, the alloy used would have to be very pure in order that excessive accumulation of impurities in the grain boundaries be prevented. Rolling or cold working of the anodes would reduce grain size.

Alloys containing less than 10% tin would offer no problem, since the delta phase can be removed by simple heating for periods long enough that equilibrium conditions be reached.

Bath Control

One of the critical factors in the operation of the bronze plating solution was the necessity of maintaining its pH above a value of 13.0, as determined with a colorimetric comparator. Very often deposits light in color, and under some conditions even a bright silverlike deposit, were formed when the pH fell to 12.7-12.8. The color of the deposit was usually a fair indication of the pH.

Because the requirements for bronze plating for nitriding stop-off were not too stringent, it was not necessary to control the bath within the close limits required in the plating of bright deposits for decorative purposes. The usual practice was to analyze the bath for all constituents at least once a week. In some cases where extremely high production or high drag-out was encountered, the baths were analyzed bi-weekly. The bath constituents were held between the following limits:

Tin as metal	2 -2.5	oz/gal
Free sodium cyanide	1.5 -2.5	"
Copper as metal	3.2 -3.5	"
Caustic soda	1.25-4.0	"
pH (colorimetric)	13.0 minimum	

Standard methods of analysis, as given in any book on plating, were used for control.

When the solutions were maintained within the above mentioned limits, the deposits analyzed from 10 to 20% tin with the re-

mainder copper. Usually the bronze deposits were bright as deposited, and it should be emphasized that the metal being plated usually had a turned or roughly-ground finish.

One frequent cause of poor deposits was the accumulation of stannous tin in the bath caused by incorrect anode corrosion or by an operator allowing the tin anodes to remain in the solution for a long period of time when the solution was not in use. It is the usual procedure in alkaline tin plating to oxidize stannous tin to stannic by the addition of hydrogen peroxide or sodium perborate. Sodium peroxide was used in the alkaline bronze solution, as it would not decompose the copper sodium cyanide complex. Thus the usual remedy for dark, spongy deposits was treatment of the bath with sodium peroxide and, of course, correction of the anode corrosion to prevent further formation of the stannous ion. Furthermore, sodium peroxide was always added when an addition of sodium stannate was made, in the ratio of 2 grams of peroxide per pound of stannate.

Stripping Methods

The method used for stripping tin did not suffice for the alloy deposit. A study of stripping methods disclosed that concentrated nitric acid would strip the bronze deposits, but its use was not recommended because dilution of the acid by drag-in of water would cause the steel base to pit. Anodic treatment in a strongly caustic cyanide solution would remove bronze as deposited but was not satisfactory when the bronze had been subjected to a nitriding cycle, as it allowed a residue, light in color, to remain on the work. A highly caustic, well buffered proprietary solution was found to work with reasonable success. An addition of sodium chloride to this solution was finally found to give the desired result.

Bronze Plating for Decoration

There may be considerable use for bronze plating on hardware and similar articles for decorative purposes. The success depends on the corrosion resistance of the bronze and its ability to protect the base metal. Since bronze is usually cathodic to steel, the coating must be continuous, i.e. free of pores or similar faults. Alloy deposits are usually fine grained and bronze is no exception. This factor aids the production of thin, pore free deposits. As mentioned previously, Baier and Macnaughtan found 0.0003 in. thick bronze deposits to be free from pores. Such thin deposits were not tested by us, but our experimental work did indicate that 0.0005 in. of bronze had satisfactory corrosion resistance. It should be emphasized that these deposits were plated in regular production without special filtering or cleaning.

Although the value of accelerated corrosion tests is open to question, it is interesting to note that initial corrosion was found on polished and grit blasted steel panels with 0.0005 in. thick bronze coatings after 168 hours in the standard salt spray test (95°F, 20% salt solution) and on panels with 0.001 in. thick bronze coatings after 200 hours. It required slightly over two months' humidity test at 120°F and 97-100% relative humidity to corrode similar panels. In all cases the bronze itself corroded and failure was not caused by corrosion through pores in the deposits.

The observation that bronze plated parts have stood up very well in both indoor and outdoor service is of great significance.

A.S.T.M. SPRING MEETING

(*Continued from page* 391)

spray box, as well as the paper by C. F. Nixon, "A Modified Salt Spray Test for Chromium Plated Zinc Base Die Castings", published in the November issue of MONTHLY REVIEW. A working Committee of this Sub-Committee is actively collecting specimens for the further evaluation of the salt spray test.

Three papers of considerable interest, which were presented at the general A.S.T.M. meeting, concerned statistical quality control in its application to specification requirements and to the planning of atmospheric exposure tests. It is hoped that a larger number of people will familiarize themselves with these fundamentally important concepts, the value of which was clearly demonstrated during the war.

GUSTAF SODERBERG,
Assistant Editor

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Introduction

GRADE VI stainless steel as specified in Federal Specification QQ-S-76B contains a minimum of 13% chromium. Since a true stainless steel must have a chromium content of at least 17%, the corrosion resistance of Grade VI stainless is comparatively low.

Our usage of the 13% chromium steel required a surface with the highest possible corrosion resistance. With this view in mind, a rather extensive laboratory study was undertaken. The variables studied include surface finish, passivation and chromium plating.

The corrosion resistance was measured by exposure to the salt spray test and to gasolines saturated with water or salt solution. Atmospheric corrosion tests were also initiated, but have not yet yielded sufficient data for inclusion here.

Effect of Chromium Plating on Salt Spray Resistance

Chromium has never been considered to have much value as a protective coating on ordinary carbon steels except when relatively heavy deposits were applied. Preliminary work had shown that chromium flash plate on a low chromium stainless steel resulted in a remarkable increase in salt spray resistance over that exhibited by untreated specimens and by passivated (immunized) specimens of the same type steel.

To further study the effect of chromium plate as a protective finish on stainless steel, a series of panels were prepared and plated with chromium to thicknesses ranging from 0.00005 to 0.0005 inch. The panels were 0.072 inch thick and measured 2¼ inch by 1 inch. The surface of the panels was polished to remove any oxide condition and the two short ends were coated with stop-off lacquer to a depth of approximately ¼ inch to eliminate having to test any area with too heavy or burned and powdery deposit.

The panels were chromium plated in a standard chromic acid bath containing 33 oz/gal chromic acid and 0.33 oz/gal sulphuric acid at 2 amp/sq. in. The respective thicknesses were obtained by variation of the time of plating, the time factor having been determined by plating a number of standard panels at the standard current density and determining the thickness of the electrodeposit.

TABLE I

Effect of Chromium Plate Thickness on Salt Spray Resistance

Total time of test 625 hours

Thickness in.	Hours before rusting				
	Initial	Localized	General		Complete
			Slight	Heavy	
0.00005	96	144	—	—	—
"	408	—	—	—	—
0.000075	144	448	—	—	—
0.0001	144	408	—	—	—
"	552	—	—	—	—
0.00015	216	—	336	—	—
"	408	432	625	—	—
0.00020	240	336	408	—	—
"	216	336	625	—	—
0.00025	216	—	336	—	—
"	216	336	—	—	—
0.00030	144	—	168	216	336
"	240	—	288	336	—
0.00035	120	—	144	336	—
"	240	432	—	—	—
0.00040	120	—	144	336	—
"	120	144	168	336	—
0.00045	120	—	144	408	—
"	—	—	408	—	—
0.00050	144	168	336	—	—
"	264	—	408	—	—

Forty-four panels prepared in the above manner were plated to eleven different thicknesses of chromium, four panels to each thickness. Two of the four panels were tested in the salt spray and the other two were reserved for atmospheric corrosion test. It is believed that the salt spray test has some value in predicting the behavior of parts exposed in coastal atmospheres.

The information obtained from the salt spray corrosion test of the chromium plated panels is contained in Table I. An examination indicates a rather high salt spray resistance at the low thicknesses of chromium, with decreasing resistance as the thickness of chromium increases. Beyond

TABLE II

Effect of Surface Condition on Salt Spray Resistance

Time of test 150 hours
Observations recorded at 24 and 150 hours*
Test specimens in quadruplicate

Legend of extent of rusting:

0 = None
1 = Very light initial
2 = Light localized
3 = Light general
4 = Heavy general
5 = Complete breakdown

*A = 24 hrs.; B = 150 hrs.

Parts Name	Roto finished				Unfinished				Buffed			
	Passivated		Chromium plated		Passivated		Chromium plated		Passivated		Chromium plated	
	A	B	A	B	A	B	A	B	A	B	A	B
	3	5	2	3	5	5	2	3	5	5	1	2
Mixture	3	4	2	3	5	5	2	3	5	5	1	2
control	3	5	2	3	5	5	2	3	5	5	1	2
shaft	3	5	2	3	5	5	2	3	4	5	1	2
Average	3	5	2	3	5	5	2	3	4.8	5	1	2
	3	5	1	3	3	5	1	3	3	5	1	2
	3	5	1	3	3	5	1	3	3	5	1	2
Vapor trap	3	5	2	2	5	5	2	3	4	5	1	2
screw	3	5	2	3	5	5	2	3	5	5	1	2
Average	3	5	1.5	2.8	4	5	1.5	3	3.8	5	1	2
	5	5	0	2	5	5	2	3	5	5	1	2
Pressure	5	5	1	2	5	5	2	3	5	5	1	2
meter fuel	5	5	2	3	5	5	3	4	5	5	1	2
valve seat	5	5	1	3	5	5	2	4	5	5	1	2
Average	5	5	1	2.5	5	5	2.3	3.5	5	5	1	2
	3	5	1	3	3	5	1	3	5	5	0	2
Pressure	3	5	1	2	3	5	1	3	4	5	1	2
regulator	3	5	1	2	3	5	2	3	4	5	0	2
valve	3	5	1	2	-	-	-	-	-	-	1	3
Average	3	5	1	2.3	3	5	1.3	3	4.3	5	0.5	2.3
	3	5	1	3	2	5	1	3	2	4	1	3
Sleeve	2	5	1	3	2	5	1	3	2	4	1	2
	2	4	1	2	2	4	1	2	2	4	1	2
	2	4	1	2	2	4	1	2	2	4	1	2
Average	2.3	4.5	1	2.5	2	4.5	1	2.5	2	4	1	2.3
Grand Average	3.3	4.9	1.3	2.6	3.8	4.9	1.6	3.0	3.9	4.8	0.9	2.1

a given thickness, the salt spray resistance increases and levels off. The data indicates that the optimum thickness of chromium would be a flash plate not exceeding 0.0002 inch or, if a heavier deposit were required, one not less than 0.00045 inch. Coatings of intermediate thicknesses of 0.0002 inch to 0.00045 inch are accompanied by a sharp decrease in salt spray resistance. Thirteen percent chromium steel with no chromium plate, whether passivated or not, has proven, in salt spray exposure tests, far inferior to the same type of steel with any specified thickness of chromium.

Effect of Surface Condition on Salt Spray Resistance

A highly polished surface is known to resist corrosion more readily than one which is unpolished or rough. It was not known to what extent roto-finishing (tumbling with granite chips) would affect the salt spray resistance.

Five different carburetor parts made of 13 percent chromium steel were prepared. Three types of surface conditions were tested: (1) roto-finished, (2) highly polished, and (3) no treatment. The roto-finished specimens were prepared by tumbling in a rotating barrel with granite chips for one hour and a half. The highly polished specimens were prepared by buffing in the conventional manner on an unstitched wheel with a mildly abrasive compound. The untreated specimens, of course, received no special treatment. For each of the three types of surface, two finishes were applied. The first finish was obtained by passivation, or immunizing, in 20% nitric acid solution for 15 minutes at 140 degrees Fahrenheit. The second finish was a chromium flash plate, the plating being done in a standard chromic acid plating bath, with approximately 0.00005 to 0.000075 inch of chromium deposited.

All of the parts were tested in 20% salt spray fog. The equipment was a standard unit manufactured by Industrial Filter & Pump Mfg. Co. Inspection of the parts was made every 24 hours and the progress of breakdown noted.

On the examination of the data in Table II, one fact stands out above all others, i.e. the superiority of chromium flash plate over passivation as a corrosion resistant finish. All passivated parts showed complete breakdown after relatively short exposure, yet without exception, for every part tested, the chromium finish showed only a mild degree of corrosion and exhibited a marked resistance toward this type of corrosion medium. This fact is most important when it is considered that passivated parts have often shown the effects of corrosion after having been in stock for only a short time.

TABLE III

Results of Simulated Carburetor Corrosion Tests

Gasolines: (a) Shell 100 Octane
(b) Shell 100 Octane 60 parts by vol.
Toluene 20 parts by vol.
Xylene 20 parts by vol.

Time in hours

Treatment	Gasoline		Gasoline and Distilled Water		Gasoline and Tap Water		Gasoline and 3% NaCl Solution		Gasoline and 20% NaCl Solution	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Passivated										
Initial attack	240+	240+	144	24	24	24	24	24	—	—
Compl. brkdwn.	240+	240+	216	144	96	96	36	36	24	24
Chromium Flashed										
Initial attack	240+	240+	—	240+	240+	240+	24	240+	240+	240+
Compl. brkdwn.	240+	240+	—	240+	240+	240+	96	240+	240+	240+

The rate of breakdown of the passivated specimens was so rapid that the type of pre-finishing appeared to make little difference. In contrast, the highly polished or buffed parts with the chromium flash finish in every case exhibited higher salt spray resistance than those which had been roto-finished. These in turn were better on the average than the chromium flashed parts with the untreated surface.

For this type of steel, the combination which appears to give the greatest protection against salt spray corrosion is a chromium flash plate on a highly polished or buffed surface (Figs. 1 to 3).

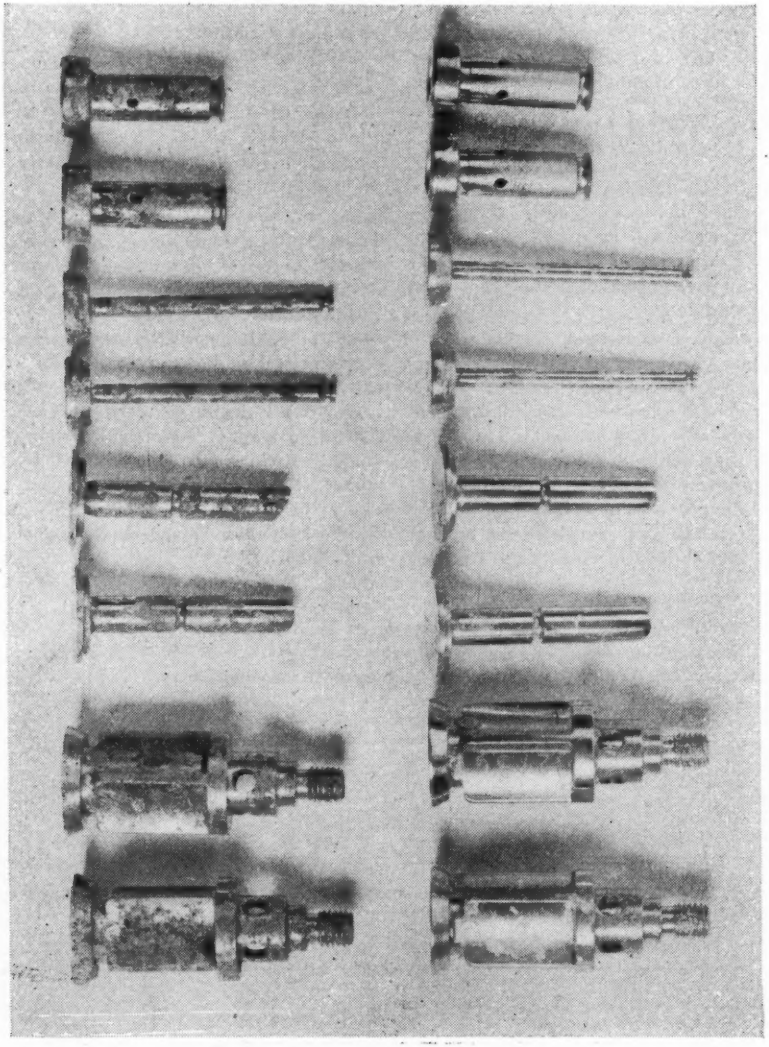

Fig. 1. Valve parts after 150 hours Salt Spray Exposure. Lect row: Passivated—note rusting. Right row: Chromium plated, 0.00005 inch—disregard salt incrustations.

The Effect of Chromium Flash Plate and Immunization under Carburetor Service Conditions

In order to obtain an idea of the comparative value under carburator conditions of (1) a chromium flash plate, 0.00005-0.000075 inch thick, and (2) a passivated or immunized surface prepared as described previously, two series of corrosion tests were run in mixtures of gasolines and aqueous solutions with air agitation. The tests were continuous, lasting ten days. Inspection of the parts under test were made on the average every 13 hours. The length of time for breakdown as well as the progress of rusting, were noted at each inspection.

Samples of load compensated valves and seats were corrosion tested under the five different sets of conditions shown in Table III, ranging from mild to severe in respect to the attack on the base metal.

The parts were suspended by means of wires so that in each case they were immersed entirely in the gasoline layer. The solutions were contained in 1500 ml. beakers, with each beaker containing two parts under test, one passivated and one chromium flashed. The wires suspending the parts were insulated with stop-off lacquer to prevent the formation of an electrolytic couple. A cover was placed over each beaker to retard evaporation of the gasoline and prevent the spreading of fumes.

Air agitation simulating conditions in airplane carburetors was used in each beaker, with the air first passing through the aqueous layer before bubbling through the gasoline layer. This caused fine drop-

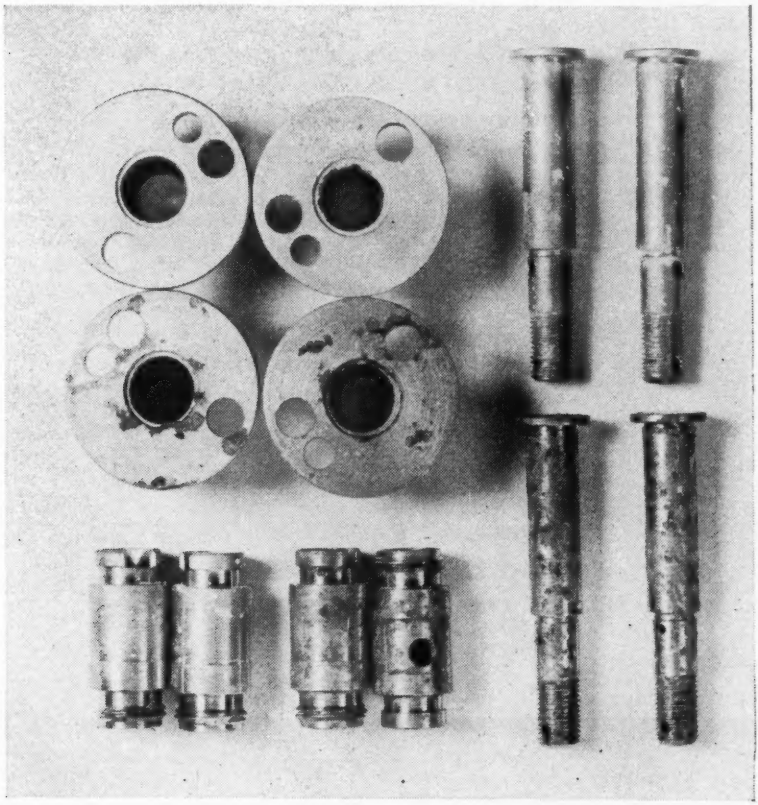

Fig. 2. Valve parts after 150 hours Salt Spray Exposure .Note absence of rusting of chromium flashed valves as compared with extreme rust condition of passivated valves.

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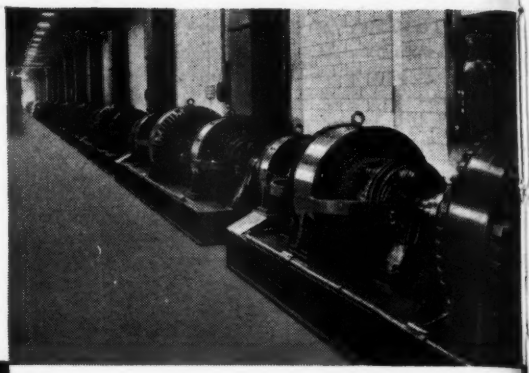

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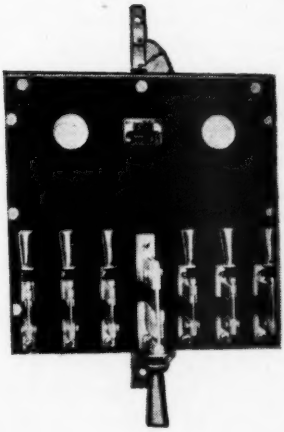

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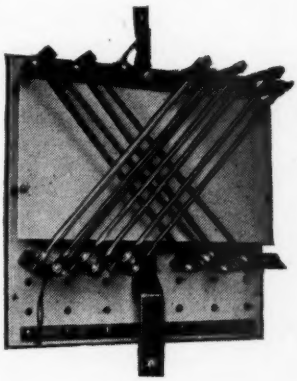

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lets of air and aqueous solution to be dispersed throughout the gasoline layer around the specimens. The air agitation was intermittant: twelve hours of agitation followed 12 hours without agitation, for the duration of the test.

The results are presented in Table III.

With the exception of the one tested in the straight 100 octane gasoline with 3% sodium chloride solution, none of the chromium flashed specimens showed any change after ten days of exposure. The valve which showed change had been improperly plated and exhibited bare low current density areas. All passivated valves, with the exception of the one which was corrosion tested in gasoline alone, showed complete breakdown after 10 days exposure.

It is evident that a chromium plate of the order of 0.00005 inch is far superior to a passivated or immunized surface as regards corrosion resistance under most severe test conditions.

Acknowledgement

My thanks are due Mr. C. B. Munton and Mr. H. E. Austen for their assistance in obtaining the experimental data.

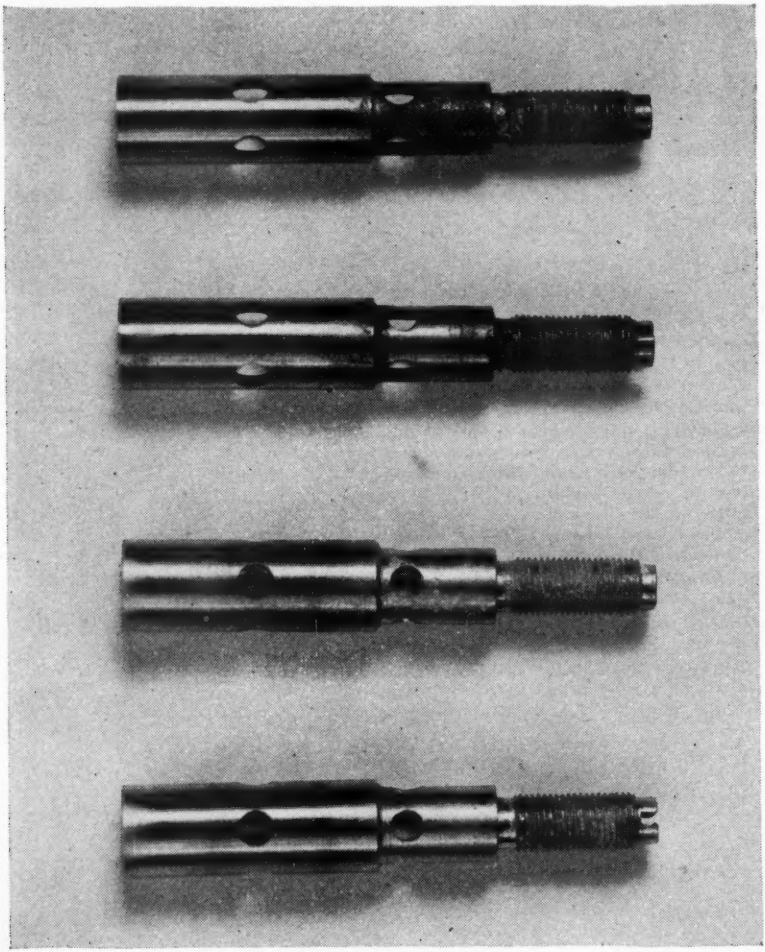

Fig. 3. Valve parts after 150 hours Salt Spray Exposure. Note absence of rusting of chromium flashed valves as compared with extreme rust condition of passivated valves.

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COMPLETE METAL FINISHING EQUIPMENT

HEALTH HAZARDS IN ELECTROPLATING

By WILLIAM BLUM
Chemist, National Bureau of Standards

This address to the School of Public Health, University of Michigan on October 4, 1945, is published with the kind permission of the School.

INTRODUCTION

THE complete finishing of metals by electroplating may include (1) polishing the base metals, (2) cleaning with solvents and alkaline solutions, (3) pickling with acids, (4) metal deposition, (5) buffing the deposits, and (6) lacquering. Only the actual electrolytic operations will be discussed in this paper.

Many of the plating operations involve the use of large volumes of solutions of poisonous materials, including strong acids and alkalis, cyanides, chromic acid, and salts of toxic metals such as lead and cadmium. In addition to the danger of contact with the solutions, there is also the hazard of inhaling poisonous gases, and sprays that are carried into the air by evolved gases. In a metal deposition process with soluble anodes, no appreciable gas or spray is evolved if the anode and cathode efficiencies are both close to 100 per cent. In many plating operations the cathode efficiency is less than 100 per cent; e.g. 70 per cent in a cyanide copper bath, and 15 per cent in a chromium bath, and the balance of the current is used in liberating hydrogen. If, as in chromium plating, insoluble anodes are used, oxygen nearly equivalent to the total current is evolved. In addition to hydrogen and oxygen, other gases may be liberated, e.g. hydrocyanic acid by the action of the carbon dioxide of the air on cyanide solutions.

The "stripping" of defective plated coatings may be accomplished either chemically or electrolytically in strongly acid or alkaline solutions, including for some purposes chromic acid or cyanides. In almost all such operations gases and sprays are evolved, and hence good local ventilation should be provided.

In view of the toxic materials employed in plating, it is surprising that very few fatalities have been reported in this industry. In fact, this occupation appears to be a "healthy" one, as judged by the longevity and activity of many "old-time" platers. No doubt this good record results in part from (1) the full realization of the hazards and hence the use of proper precautions, and (2) the fact that in the larger plants, where many persons including novices are employed, necessary safeguards have been provided. A good example is the development of commercial chromium plating since about 1925, for which extensive and usually adequate ventilation systems have been universally installed, even in small plants.

POISONOUS LIQUIDS AND SPRAYS

Acid Solutions

Typical acid plating baths include the following:

(a) *Acid copper* baths, used more in electrotyping and electroforming than in plating, consist principally of copper sulfate and sulfuric acid to which small amounts of organic "addition agents" are commonly added. Copper anodes are used and the electrode efficiencies are high, so no spray is evolved, unless excessive air agitation is used. In special cases lead anodes are employed and cause evolution of oxygen and spray.

(b) *Acid zinc* baths consist principally of zinc sulfate with additions of ammonium or aluminum chloride and organic agents. They are generally operated with zinc anodes and with a low acidity (pH = 3), resulting in high efficiencies. In the Tainton process a strongly acid zinc sulfate bath is used with insoluble anodes. In this process ventilation is required at least for comfort, even though the zinc salts and dilute sulfuric acid are not highly toxic.

(c) *Nickel* plating is done in slightly acid baths, e.g. from pH 2 to 5, and the efficiencies are relatively high. Neither the nickel salts nor the chlorides or boric acid present are toxic, and no ventilation is required. The nickel salts may however be irritant and cause nickel itch (p. 414).

(d) *Acid lead* baths consist of the fluo-

borate, fluosilicate, perchlorate or sulfamate of lead, with a fairly high concentration of the corresponding acid. The electrode efficiencies are high and very little spray is evolved. The greatest hazard is probably that of handling lead compounds, especially if they become dry and form dusts (p. 000).

Oxidizing Acid Solutions

Chromic acid, the principal constituent of chromium plating baths, has specific effects that are distinct from those of the common strong acids. Its highly oxidizing properties cause it to attack membranes, especially of the nasal tissues, and to induce "ulcers" to form wherever the skin is abraded.

It is important to note that these effects are confined to hexavalent chromium (chromic acid and chromates). Trivalent chromium, as in chromic sulfate, has no such effects, and it has been reported that large amounts can be ingested without injury. This distinction is important in considering the possible health hazards if any chromium is dissolved from cooking utensils, as then the trivalent compounds are formed and not the hexavalent.

As previously noted, there is always a large evolution of gas during chromium plating, and hence effective ventilation must be provided. Early in the development of chromium plating a study was made of the hazards involved [J. J. Bloomfield and W. Blum, Public Health Reports **43**, 2330, (1928); Reprint 1245, U. S. Public Health Service]. The results of this early exploratory study appear to be confirmed by later observations and experience. They showed that nasal injuries were likely to occur on long exposure to air containing more than 1 milligram of chromic acid in 10 cubic meters of air. It was then concluded that, under favorable conditions of cross ventilation, the desired low concentration can be maintained by drawing air through a narrow slot on one or more sides of the tank with a slot velocity of about 2000 linear feet per minute. ("Threshold limits" for the permissible concentrations of various other chemicals used in plating are not available. Purely as a first approximation, it has generally been assumed that methods and degrees of ventilation used in chromium plating processes will be adequate in other severely hazardous plating procedures. This assumption may not be warranted in special cases, e.g. in "bright dipping" in sulfuric and nitric acids, which may evolve high concentrations of oxides of nitrogen.

In the American Standard for "Safety in Electroplating Operations", approved August 13, 1941 by the American Standards Association, the degree of ventilation *suggested* for severely hazardous plating operations such as chromium plating, is expressed as equivalent to 120 cubic feet per minute for each square foot of tank surface, when drawn through a slot from 1 to 3 inches wide, extending the full length of the tank, and ventilating a width of not more than 24 inches. With a 2-inch slot and a tank width of not more than 24 inches, this volume of air results in a slot velocity of 1440 linear feet per minute, i.e. about 75 per cent of that suggested by Bloomfield and Blum.

To achieve satisfactory ventilation in chromium plating it is desirable to have the slot on the edge of the tank and the solution level at least 8 inches below the slot. Anodes and other devices should be so placed as not to interfere with the movement of gas and spray into the slot. Cross currents of air from window or other ventilators should be avoided.

Attack of the tissues by the chromic acid can be reduced by the use of vaseline in the nasal passages and on any abraded skin, and by wearing rubber gloves, aprons and waterproof shoes. Healing of chromium ulcers is fostered by early applications of a reducing agent, such as sodium bisulfite or polysulfide.

Alkaline Baths

The principal strongly alkaline bath (other than cyanide) used in plating is the alkaline tin solution. This consists principally of sodium stannate and contains sufficient free sodium hydroxide to prevent hydrolysis. Soluble tin anodes are used under conditions that prevent much formation of sodium stannite. At times additions of oxidizing agents such as hydrogen peroxide may be required to oxidize any stannite to stannate. The oxidation is sometimes done in a separate tank, operated with insoluble steel anodes. Under the latter conditions oxygen is evolved and carries out an

alkaline spray. In the normal operation of the stannate baths the electrode efficiencies are fairly high and little spray is evolved.

Neither the stannate nor the sodium hydroxide are very toxic, but inhalation of any alkaline spray causes irritation and inflammation of nasal tissues. Moderate ventilation should be provided for such processes to guard against even occasional spray.

Cyanide Baths

All of the cyanide baths, including those for copper, zinc, brass, bronze, cadmium, silver and gold plating, contain (a) a soluble double cyanide of the metal plated with either sodium or potassium, (b) some "free" sodium or potassium cyanide, and (c) in some cases, e.g. zinc baths, free sodium hydroxide. The copper baths are frequently operated at high temperatures, e.g. 70°C or 158°F, but most of the others are used at room temperature.

From all such baths there is a constant slow evolution of the very toxic hydrocyanic acid, which is more rapid if the baths are heated. This gas arises from the action of carbon dioxide of the air to form sodium carbonate and hydrocyanic acid. The reaction is retarded by the addition of free alkali to the baths. Except with heated baths, if good normal room ventilation is used the concentration of the hydrocyanic acid in the surrounding air is not likely to be sufficient to cause permanent injuries.

The most serious hazard with cyanide solutions is the possibility that acid may be introduced and cause evolution of large volumes of hydrocyanic acid. Fortunately careful precautions are taken against this possibility so that very few instances have been reported. During the early bombing of London some fatalities in plating plants were reported as a result of the mixing of cyanides and acids.

Most cyanide baths operate with efficiencies less than 100 per cent, and hence gases are evolved that carry spray into the air. For all such baths special ventilation is desirable, though usually not so much ventilation as for chromium plating in which much higher current densities are used and hence more gas is evolved from a given electrode area. In silver and gold plating from cyanide baths the volumes and the current densities are usually low and the efficiencies high, so special ventilation is not generally required.

Baths of Toxic Metals

As above indicated, many of the hazards in plating arise from the types of compounds used rather than from the inherent toxicity of the metals themselves. There are, however, several plated metals that are toxic in all their compounds, e.g. lead, cadmium, arsenic and mercury. Arsenic deposits are sometimes used to produce dark or "oxidized" finishes on copper and brass. For each of these metals specific precautions must be taken.

Cadmium poisoning may not always be recognized, because it has a delayed action. The first symptom of acute cadmium poisoning is a severe cough, followed by dizziness, shortness of breath and constrictive pain in the chest. Severe lung damage may result and prevent the lungs from supplying oxygen to the blood. Death may then quickly ensue.

One hazard is in the melting of these metals, e.g. lead or cadmium, in the casting of anodes, as any fumes evolved are extremely poisonous. Protection of workers against these metal fumes can be secured by the use of a metal fume filter respirator approved by the U. S. Bureau of Mines, by ventilation specially designed for this purpose, and by good foundry practice.

Another source of injury is the dust produced by evaporation of the baths, which may accumulate on and under tanks and floors. Daily washing down of all areas where the solutions may drip will reduce this hazard.

The handling of articles plated with toxic metals may also cause injuries to health, unless suitable care is used. For example, articles coated with toxic metals should not be subjected to high temperatures that may cause evaporation of the coatings. Deaths have occurred from machining or welding of cadmium plated parts.

It should be obvious that no toxic metals should be used on food containers or utensils. Nevertheless, instances have been reported of the use of cadmium plated ice-

trays (probably because of the shortage of tin). These caused serious illness in several instances, especially when acid fruit juices had been frozen or stored in them.

Mercury has been used as a "brightener" in zinc plating baths, and for many applications the resultant zinc deposits, which may contain one per cent of mercury, are acceptable. They should not, however, be used on any food containers or utensils.

IRRITANTS

As a medical layman I will not attempt to make a sharp distinction between "poisons" and "irritants". (You will recall Mark Twain's remark that "water is the slowest poison known. It takes 70 years to kill some people.") One of the characteristics of irritants is that their effects may be highly individualistic, and, like other "allergies", they may vary from time to time with the same individual or with his health. This situation makes it necessary to determine in each case whether a given ailment, such as dermatitis, is caused by industrial exposures or by other conditions.

Practically all salts, including chlorides and sulfates, are somewhat irritating, especially to abraded skin. The same is true of acids and alkalis even in moderate concentrations. Persons handling such materials must wear gloves and wash the face and hands frequently.

The alkaline cyanides are often very irritating to workers and may cause "cyanide sores". As previously noted, chromic acid is even more destructive to the tissues.

It was early discovered that nickel platers, especially blonds, were likely to contract "nickel itch", a severe form of skin irritation. Some years ago, in unpublished tests made by Dr. Felix Brunot of the Public Health Service, it was found that a few out of 100 employees at the National Bureau of Standards were susceptible to nickel poisoning from continued contact of metallic nickel with unabraded skin.

All such affections can best be prevented by good industrial hygiene, though some workers are so susceptible that they must be changed to other occupations. The remedies proposed, e.g. for nickel itch, are very numerous, but all involve the use of some healing ointment.

GENERAL CONCLUSIONS

The electroplating industry necessarily requires the use of toxic materials, with the dangers and effects of which all workers should be carefully instructed. With proper safeguards, including the use of gloves, aprons, and boots, available running water, good general ventilation, and adequate local ventilation, these hazards can be and generally have been so reduced that the occupation of electroplating is not a dangerous one. To paraphrase an old slogan, "Eternal vigilance is the price of safety" in this as in other fields.

I am indebted to Lt. E. E. Adams and Commander J. J. Bloomfield of the Public Health Service for information and advice in the preparation of this paper.

3rd International A. E. S. Educational Session

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2:00 P. M.

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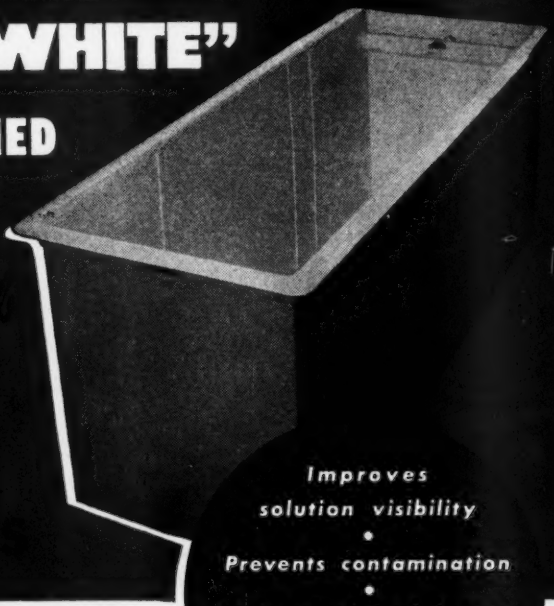

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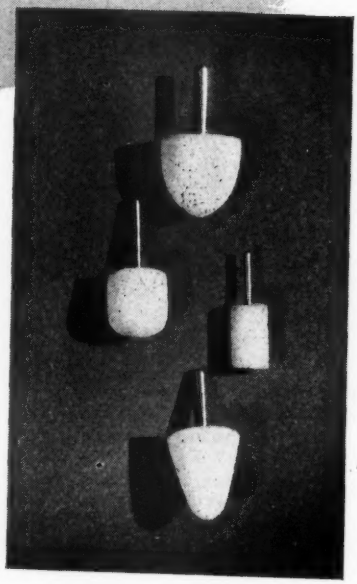

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The Reader's Corner

CADMIUM WHISKERS

Sirs:

I WAS greatly intrigued by the description in the January issue of the REVIEW of the so-called cadmium "whiskers" which grow on condenser plates. Although I would not care to speculate concerning their origin without a great deal more information, I would like to offer a suggestion as to their possible composition.

From the notes appended by the Editor on pages 29 and 95 of the article, it is evident that the "whiskers" cannot consist of pure metal, neither are they pure salts. The specific resistivity of the material is somewhere between that of a metal and a salt. Now, it is well known that cadmium forms a number of "sub" compounds, which were at one time believed to contain the element cadmium with a valence of unity, instead of the usual value of two. In one case, at least, it has been shown that the "sub" compound is actually a mixture (or solid solution) of the normal salt and metallic cadmium. Such a substance would have just the electrical resistance properties found for the "whiskers". Is it possible that the "whiskers" do actually consist of material similar in nature to the "sub" compounds of cadmium?

SAMUEL GLASSTONE

ERRATA! !

"Adhesion of Electrodeposits"—Reader's Corner, March Review

The Editor exceedingly regrets that serious errors marred the excellent contribution by Dr. Faust in the March MONTHLY REVIEW on the "Adhesion of Electrodeposits". Microphotographs accompanying Dr. Faust's letter to the Reader's Corner were transposed.

To correct this error, relate photo 4 to caption Fig. 1, photo 1 to caption Fig. 3, and photo 3 to caption Fig. 4.

Figure 2 and its caption are correct as shown.

Apologies are due the author as well as the readers for these errors, which made the reasoning in the article so difficult to follow.

A Moment Please —

From MONTHLY REVIEW page 140, February, 1940:

"At the 27th Annual Convention held at Asbury Park, N. J. every Branch displayed an exhibit of its plated ware, making a 100% exhibit. It has taken twenty-seven years to reach this percentage."

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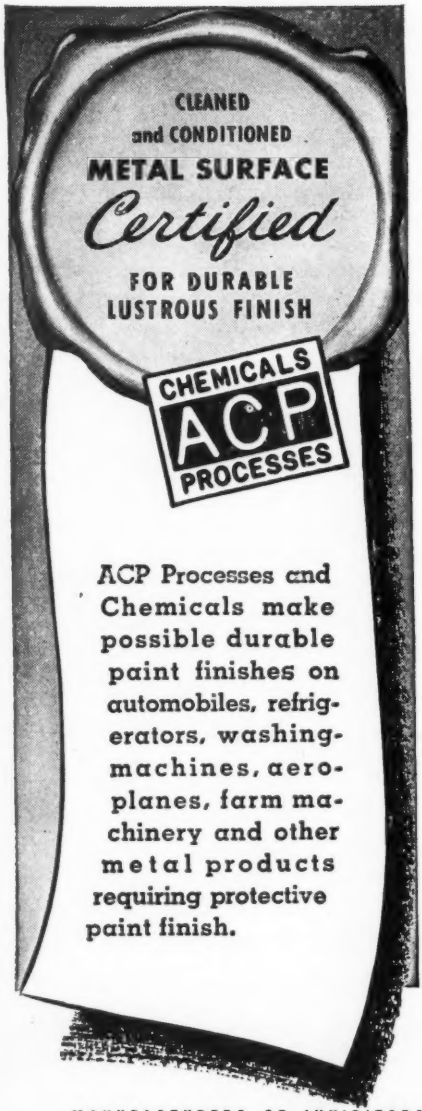

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REVISION OF BY-LAWS

Proposed by Detroit and Pittsburgh Branches

The Detroit Branch sponsors the following amendments to the By-Laws:

Part I, Article VI, Sect. 1 which now reads: "Applications: Each Branch Society shall send the name of each applicant for membership to the Executive Secretary who shall publish the name in the MONTHLY REVIEW. No application shall be acted upon by the Branch Society until ten (10) days after such publication," to read:

"Applications: Each Branch Society shall keep a record of the name of each applicant for membership. No applicant shall be elected to membership until his application has been acted upon by the Board of Managers."

Part II, Article II, Sect. 4, second and third sentences, which now read: "He shall send to the Executive Secretary the names of all applicants for membership. He shall send a corrected list of the membership of the Branch Society to the Executive Secretary with the quarterly payment of dues," to read:

"He shall keep a record of the names of all applicants for membership. He shall send a corrected list of the membership of the Branch Society to the Executive Secretary at least once a year, and shall forward a list of all changes and additions each month."

The Pittsburgh Branch sponsors the following amendment to the By-Laws:

Part I, Article IV, Sect. 4 (b), which now reads:

"Registration Fee: A maximum registration fee of $5.00 per person shall entitle a registrant to participate in all activities of the Convention including banquets and other entertainment, including transportation on plant visitations," to read:

"Registration Fee: The registration fee of the Convention shall be determined by the Branch Society sponsoring the Convention subject to the approval of the Executive Board."

The motivitation for the proposal of the Detroit Branch is the desire to decrease the heavy burdens now imposed upon Branch Secretaries and to facilitate the operation of the Branch.

The purpose of the amendment sponsored by the Pittsburgh Branch is to permit the Branch to make Conventions self-sustaining whenever that, in the judgment of the Branch and the Executive Board, appears desirable.

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By FRANK K. SAVAGE

Chairman, Program and Educational Committee

Surface-Conversion Coatings

GEORGE W. JERNSTEDT. ASTM Bulletin No. 137, 29-35 (1945).

Surface conversion coatings are almost always the result of oxidation of one form or another, and generally are relatively thin and nonflexible. This type of coating cannot be drawn or bent without some fracturing of the film. The tendency today is toward the development of finer-grained (smaller crystals in anodizing, phosphating, etc.) finishes for aluminum, magnesium, zinc, and steel, so that the base metals may be processed in the strip mill and then formed to the finished part with few or no finishing operations after forming. Strip steel is being bonderized for such applications. In addition, several lines are in operation in the steel mills in which the strip steel is coated with zinc and then phosphated. The black ferrous-ferric oxide coating process is discussed. A table showing the characteristics of surface-conversion coatings is included.

Chromium Plating of Lathe Tools, Advantages and Limits

H. SCHALLBROCH and W. HIELSCHER. *The Engineers' Digest* **3**, 33-35 (1946); Z.V.D.I. **88**, 23-24, 321-326 (1944).

Tests show that through chromium plating, the life of lathe tools can be extended on an average from 2 to 5 times, and with suitable working materials from 8 to 11 times. Different methods of chromium plating influence the cutting capacity to different extents. While chromium plating improves the cutting properties, the shape of the chips produced is not so desirable. The limits for chromium plated tools: 300 to 350°C working temperature and 200 to 250 kg/mm^2 thrust must be observed strictly. Not all tool materials are equally suitable for chromium plating. It remains to be determined whether equally good results can be obtained under less well defined conditions in workshops. Chromium plating can be recommended where suitable working materials are to be machined.

Chromium-Plating of Cutting Tools

EDWIN H. HALVERSON. *Tool Engineer* **15**, 43-44 (November 1945).

When chromium is electrodeposited upon any material which is subjected to shock or high pressures, the caged hydrogen within the plate expands by any heat generated and seeks to escape by forcing the plate away from the underlying material (termed spalling, chipping or peeling); also, the remaining hydrogen in the deposited plate causes it to be what is called "hydrogen embrittled". Therefore, chromium-plating on any material subjected to shock or high pressures has not been recommended in the past. A new method of heat treating electrodeposited chromium in any thickness from 0.000006 to 0.00003 inch causes the hydrogen to "ooze" out, making the plate an integral part of the underlying material. The process is not critical and quite simple to operate, and its cost is reasonable. It has been stated that some tools of irregular shape may not be as simple to plate as

some which have regular surfaces. With this the writer concurs, but claims that the problems are not so difficult that the average engineer cannot overcome them in a very short time. This fact is fully substantiated by reports of manufacturers, a few of which are quoted. A chart is given of cutting tool applications and the results of comparative performance tests taken from reports received. Methods and benefits of the process are briefly outlined.

Chromium Plating Increases Life of Forge Dies

Z.V.D.I., 67-68 (Feb. 1945); *Engineers' Digest* **2**, 549 (November 1945).

The life of forge dies can be increased successfully by chromium plating. It can be applied to dies for light to medium-weight forgings with various, except very deep, engravings. In the case of the latter, it will be of advantage to apply chromium at least to those parts of the surface which are in the path of the overflowing material, since by this means the wear will be reduced considerably. Several pictures of dies accompany this paper and comments upon the benefits of chromium are given. An increase of life due to chromium plating is always possible with dies made of ordinary steel, but it is not always possible with dies made of special steel. The process is described.

Thickness Measurements of Thin Coatings by X-Ray Absorption

L. S. BIRKE and W. FRIEDMAN — U.S. Naval Research Laboratory; *Bull. Am. Phys. Soc.* **20**, 8 (Oct. 31, 1945).

An X-ray absorption method was applied to the measurement of thin films on thick crystalline or polycrystalline backings. Characteristic X-rays were reflected from the base material at one of Bragg diffraction angles, and the diffracted intensity measured by a Geiger counter system. When the base material was covered with a thin coating, the X-rays were reduced in intensity according to the exponential absorption law for the coating material. From the measured ratio of intensities for the coated and uncoated backing, the geometry of the arrangement and the known absorption coefficient for the coating, it was possible to compute the thickness of the coating. Measurements were made with a powder diffraction spectrometer utilizing the focusing principle. The area of specimen covered by the X-ray beam was varied between one square centimeter and one square millimeter. Metal plating thicknesses were determined in the range 10^{-5} to 10^{-2} centimeters. The method is generally applicable to coatings of any material or combination of materials with known X-ray absorption.

Spectrophotometric Determination of Nitrate in Plating Baths

ALBERT DOLANCE and PAUL W. HEALY. *Ind. Eng. Chem.* (Anal. Ed.) **17**, Ed.) **17**, 740-741 (1945).

Method is described for determination of nitrates in silver plating baths, using quartz spectrophotometer, which for routine analysis is accurate to within 2.5 grams per liter. Four references.

A Selective Spot Test for Copper

PHILIP W. WEST. *Ind. Eng. Chem.* (Anal. Ed.) **17**, 740-741 (1945).

Test is based on reaction between copper and dithio-oxamide. By utilizing malonic acid and ethylenediamine to sequester interfering ions, all important interferences with this familiar reaction have been inhibited. Test is capable of detecting 0.3 microgram of copper at a limiting concentration of 1 to 100,000. No prior separations are necessary. Eleven references.

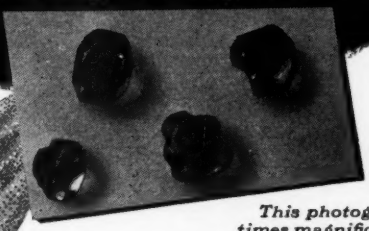
Felt Plays Polishing Role on Hard Metals

Am. Machinist **89**, 104 (Nov. 8, 1945).

Durable felt bobs are performing a range of polishing and buffing jobs on stainless steel and other metals, including airplane engine parts having irregular contours, which a plain grinding wheel could not handle evenly. Among the qualities of felt are: it can be shaped to fit the surface to be finished; the natural abrasiveness of the wool fibre; it can be coated with abrasive grains; its elasticity.

ANOTHER HARSHAW DEVELOPMENT FOR BETTER PLATING

NEW SINGLE NICKEL SALTS
small definite crystals



NOT A POWDER

This photograph, at five times magnification, shows the uniformity of crystal size.

A unique process, developed by Harshaw, now makes it possible to produce single nickel salts as small definite crystals of carefully controlled size. Advantages, when compared with the larger crystals formerly produced, are numerous.

- **Uniformly Small Crystals . . . Not a Powder** —Harshaw's unique manufacturing process controls the uniformity of crystal size and shape.
- **High Purity . . . High Nickel Content**—These uniformly small $NiSO_4$-$6H_2O$ crystals are the purest, highest nickel content nickel salts we have ever made.
- **Rapid Solubility** — Small crystals provide a large surface area. Solubility is rapid, saving time and trouble in preparing solutions.
- **Free Flowing**—When kept under reasonable storage conditions, these salts remain free flowing—lumping and caking are eliminated.

Harshaw is ready to help you with this new development for better work. Order now from your nearest Harshaw branch.

***New* SHIPPING PACKAGE**

This new type of nickel salts now makes possible the use of strong 5-ply paper bags containing 100 lbs. net. Easy to handle — they stack conveniently and pour in a free flowing stream.

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Alsop's New "SEALED-DISC" FILTERS for your electroplating work

Consider the remarkable features that have already made Alsop Filtration so successful on practically all types of solutions and in high speed or still tank installations.

It's no wonder so many platers (our users) say, "The Alsop Sealed-Disc Filter has all we want and more." You, too, can use the "Sealed-Disc" Filter for the same positive, trouble-free plating.

Our Engineering Service plus our Laboratory facilities have been very helpful to many of our customers. Perhaps we can help you, too. We'd like to try. Just write us giving details of solutions to be filtered, there's no obligation.

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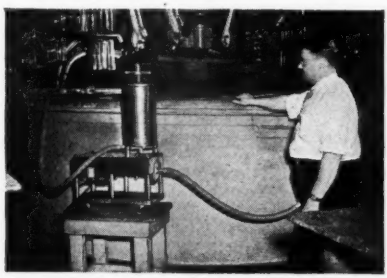
104 Fine Street, Milldale, Connecticut

Check THESE FEATURES

Alsop's New "Sealed-Disc" Filter offers many advantages, including these:

1. Completely enclosed, air-tight unit, eliminating loss through leakage or dripping.
2. Exceptionally small space requirement. For example, a 600 gals. per hour filter complete with pump and motor requires only a 9"x20" floor space; a 2000 gals. per hour machine requires only 12"x24" of floor space.
3. Filter discs can be changed quickly and easily even when changing from one solution to another. Anyone can do it in a very few minutes.
4. Made in sizes, with or without pumps, from 1 gallon per minute up to thousands of gallons per hour.



This 600 gals. per hour filter effectively keeps an automatic plating tank free from dirt, dust and other impurities. Several of these filters can be used on different stages or solutions including the cleaner for certain types of work.

BOOK REVIEWS

By DR. HAROLD J. READ
Associate Professor of Metallurgy
The Pennsylvania State College

PRINCIPLES OF INDUSTRIAL PROCESS CONTROL by Donald P. Eckman, x + 237 pages. John Wiley and Sons, Inc., New York. Price $3.50.

TO meet the rigid specifications of both process and product demanded by modern technology, the industrial operator must rely on automatic controls. There has long been need for a book devoted to the theory and principles underlying the gadgets and little black boxes that serve his purpose. A knowledge of the basic ideas and the possibilities and the limitations of his control instruments and devices will prove a valuable asset in making the most profitable use of them. Mr. Eckman has gone far toward filling this need.

It is true that particularly in the last decade or so there have appeared journal articles dealing with instrumentation in general, but they have been fragmentary and, of necessity, much too brief to present a complete picture of the field. Far more articles have discussed individual problems in considerable detail. Mr. Eckman has expertly winnowed the chaff of particular application from the grain of general theory and widely applicable principles, and has presented his findings in a terse but explicit, succinct style that can be read with ease. While there are a few passages which call for a mathematical knowledge extending to differential equations for a complete grasp of the presentation, the lack of such a mathematical background will not interfere with understanding and appreciation of by far the greater proportion of the text.

The book has been written with great care — every term is as exactly defined as a mathematician's symbol and used throughout the book in only the defined sense; there are remarkably few errors of typography or fact; in short, there is every evidence of painstaking thinking, writing and correction.

It should be emphasized that this text is not a thinly disguised compilation of manufacturers' catalogs as is all too often the case in writings having to do with instrumentation. The reader will not, for instance, be regaled with a screw by screw description of Dingus and Company's new Gadgetstat. Far from it. He will learn of lag coefficients, response curves, dead times, transfer lags and a host of other things which will allow him to understand and evaluate in terms of his control problems the limitations and, mayhap, the possibilities of the Gadgetstat when it comes to his attention. Various types of devices and equipment are discussed and schematically illustrated, but only in general terms and in direct connection with and for illustration of the idea or principle under discussion.

The experimental and research worker will also find this book of great value, for its content is just as applicable to automatic control and recording in the laboratory as to industrial processes on a plant scale — perhaps more so.

Although the generality of the text has been emphasized, the reviewer would be remiss if he did not point out that particular problems of control are dealt with from time to time in the discussion. A number of these will be of great interest to the electroplater, e.g., control of temperature, liquid level and solution flow.

At the end of each chapter is a list of pertinent literature references — some 120 in all, but there is no indication within the chapter as to where each individual reference applies. The final item of the text is a glossary of terms used in automatic control which is based on terminology accepted by an A.S.M.E. committee.

Don't get caught with inadequate protection

HALF-WAY measures for the prevention of corrosion in your plating tanks make for a deceptive feeling of security until it is too late. Complete protection, obtainable by using tank materials that have been proved the best for your specific corrosion conditions, is your best assurance of profitable operation.

There is no guesswork in your tank constructions when they are planned by Storts engineers and Stortswelded for maximum utility and dependability. Make a note to investigate this cost-cutting helpfulness on your future requirements.

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Manufacturers of Welded Fabrications to Specification

ADELAIDE BRANCH

The inaugural meeting of the Adelaide Branch was held in the Liberal Club Building, North Terrace, on January 23.

The election of officers for 1946 had the following outcome:

President—W. J. Blanch; Vice Presidents—S. W. R. Donnon and E. Geddes; Secretary-Treasurer—G. Dixon; Technical Committee—I. Wiles, J. Magnusson, E. Williams, M. Stewart and M. Boyce (Technical Secretary).

The functions of the Technical Committee are to arrange the year's programme, publication of papers and question box, and to make investigations at the request of the council.

Application forms were filled in at the meeting. The Branch has set out to enroll 100 members by the end of 1946. Regular monthly meetings are to be held throughout the year and several plant visitations are planned.

The President addressed the meeting on "Rack Design and Insulation". This was illustrated with samples of various racks for the benefit of members.

G. DIXON, *Secretary*

INDIANAPOLIS BRANCH

The February meeting of the Indianapolis Branch was held at Fox's Steak House on February 6. Following a steak dinner, enjoyed by 21 members, President Carl R. Morris conducted the business session.

Clark A. Swinehart, Chairman of the Papers Committee, reported that good progress was being made on obtaining a number of papers. H. B. Schock, Membership Chairman, announced that membership prospects looked good and turned in six new applications. James J. Monagle, Research Chairman, stated that the present industrial conditions had slowed down the drive for sustaining memberships.

It was brought to the attention of the members that the Indiana State Labor Division is preparing a Code of Plating Room Safety Regulations. The membership discussed this matter and decided that the tentative code should be investigated in order that possibly unreasonable regulations be forestalled.

The following members have been discharged from the Armed Forces: Rex W. Oyler, who is again associated with the Guide Lamp Division of the General Motors Corporation at Anderson, Indiana; M. M. Beckwith, now employed by The Harshaw Chemical Company in Cleveland, Ohio; and Emory C. Guerin, who has returned to the McClelland Casket Hardware Company of Richmond, Indiana.

At the March meeting, Dr. Abraham Max of the R.C.A. Victor Division will present a paper on "Copper Electroforming of Record Matrices".

Q. O. SHOCKLEY, *Secretary-Treasurer*

PHILADELPHIA BRANCH

Philadelphia Branch held a well-attended dinner meeting on the 4th Friday of February, Washington's Birthday, at the Broadwood Hotel.

Al Hirsch introduced the speaker of the evening, Mr. Samuel Heiman, a member of the Branch, whose subject was "Plating on Aluminum". His presentation was based on 1½ years production experience with silver plating on aluminum radar parts. The substitution of aluminum for the brass previously used had resulted in considerable saving in weight. The long history of efforts to plate on aluminum was reviewed. The present anodic and zinc immersion pretreatments were discussed in detail and critically evaluated.

With proper technique, plating on aluminum is no more difficult than and yields as satisfactory deposits as other common

plating processes. The corrosion resistance, however, is relatively low and plated aluminum is satisfactory for indoor use only. Future wide-spread applications of the process, especially for outdoor use, will depend on improvements in this direction.

After the usual questions and answers, the speaker received a rising vote of thanks.

Three applications for membership were referred to the Board of Managers. There were one election to membership, one intransfer and one suspension for non-payment of dues.

PAUL MENTZER, SR., *Secretary*

NEWARK BRANCH

All officers and 56 members were in attendance at the meeting on February 15 at the Hotel Robert Treat.

The Branch voted to donate $25.00 to the American Red Cross.

There were two elections and two applications for membership.

Our guest speaker for the evening being unable to appear, it once more became necessary for our good librarian, Howard L. Cobb, to take it upon himself to make the educational session interesting. He brought up the subject of "Addition and Brightening Agents in Plating Solutions", the discussion of which will make excellent material for our next Year Book.

GEORGE WAGNER, *Secretary*

BALTIMORE-WASHINGTON BRANCH

With the assistance of ideal weather, the 18th Annual Educational Session and Banquet on February 16 at the Maryland Yacht Club in Baltimore lived up to its glowing pre-notices. The 117 members and guests who attended experienced NEVER A DULL MOMENT.

The Educational Session started at 3:30 p.m. Only essential business was transacted in order to allow full scope for the excellent array of technical papers:

"Practical Application of Plating on Aluminum", by Mr. Robert A. Ehrhardt, Finish Engineer, Bell Telephone Laboratories, Inc.

"High Speed Nickel Plating from High Chloride Ion Baths" by Mr. Walter Pinner, President of the Supreme Society and Technical Manager of Houdaille-Hershey Corporation.

"Heavy Silver Plating on Bearings" by Mr. F. C. Mesle, Past President of the Supreme Society and Superintendent of the Bearing Plating Division, Oneida Ltd.

The papers were well presented and well received.

The dinner, entertainment and dancing that followed were all thoroughly enjoyable, the high spot being the presentation by Tom Slattery of a MUG—type undesignated—to Supreme President Walter Pinner.

ALBERT G. TAYLOR, *Sec'y-Treasurer*

BRIDGEPORT BRANCH

The regular monthly meeting was held on February 1 in the Hotel Barnum. President H. C. Braun opened the meeting with 36 members and guests present.

Wm. Ehrencrona and his Committee were given a rising vote of thanks for a very good evening of food and fun at the Old Timer's Night.

The Membership Committee reported two applications for membership.

A. R. McNeil, member of the Sick Committee, announced the death of Gerald DeRosa, a member of our Branch. The members expressed their deepest regret to the family with a floral offering. Mrs. Fred Norgren, wife of Fred Norgren of the New Haven Branch, had passed away. The Bridgeport Branch members expressed their deep sympathy to the bereaved family. President H. C. Braun reported Mrs. McGrath, wife of member James McGrath, very sick.

A letter was received from F. W. Smith, Secretary of the New England Regional Convention, to the effect that the Convention has been definitely set for May 4, 1946, at the Hotel Bond, Hartford, Conn., with the Educational Session starting at 2:00 p.m., and the Banquet scheduled for 7:00 p.m. The Bridgeport Branch members of the New England Regional Committee are: Herman C. Braun, Chairman, Wm. A. Ehrencrona, Art. R. McNeil, Dr. Walter R. Meyer, and Clarence C. Helmle.

Wm. Ehrencrona reported that as a result of agreement reached at the Regional Committee meeting held at Waterbury, January 26, Branch responsibilities will be divided as follows:

Waterbury Branch—Advertising

Hartford Branch—Program, Banquet and Entertainment
New Haven Branch—Tickets
Bridgeport Branch—Speakers and Educational Program

R. J. Kwasnik conducted the Educational Session.

JOSEPH G. STERLING, *Secretary-Treasurer*

BRIDGEPORT BRANCH

An open meeting and Educational Session was held on February 15 at the Hotel Barnum. Technical Chairman C. C. Helmle opened the meeting with 65 members and guests present.

The scheduled speaker, Dr. Richard B. Saltonstall of the Udylite Corporation, Detroit, Mich., was unable to be present. C. C. Helmle introduced Mr. Henry Strow of MacDermid Incorporated, Waterbury, Conn., who spoke on "Bright Nickel Plating and Plating Room Layouts". Mr. Strow, who is well qualified to speak on this subject because of his training and years of experience, gave many interesting details of the operation of bright nickel solutions. During the discussion many questions were asked and nicely answered by Mr. Strow.

JOSEPH G. STERLING, *Secretary-Treasurer*

TWIN CITY BRANCH

Forty members and guests met at the Covered Wago Lodge Room on March 4.

President Paul Felt opened the meeting by introducing the guests. The door prize, an Eversharp fountain pen, donated by Ray Krieger of Capital Plating Company, St. Paul, was won by Mr. Hal Johnson of Minneapolis Honeywell Regulator Company, a guest at the meeting.

E. H. Lindeman, Chairman of the Branch Research Committee, stated that his committee was following closely prospects for donations or sustaining memberships. Mr. Gunnar Deedon, Chairman of the Convention Exhibits Committee, reported that his committee is active.

Librarian Ralph Bowman introduced Mr. B. F. Lewis of Northwest Chemical Company, Detroit, who spoke on "Metal Cleaning and Adhesion of Electrodeposits". Mr. Lewis' paper was well presented and several questions were asked from the floor.

ROBERT L. BUCKLEY, *Secretary-Treasurer*

SYDNEY BRANCH

At the February Meeting the resignations of the newly elected Secretary-Treasurer, Mr. Charles Freeman, and Manager, Mr. Glen S. R. Walker, were accepted. The following officers were elected to replace them: John R. Godfrey, Secretary-Treasurer, and Thomas Wilson, Manager.

J. R. GODFREY, *Secretary-Treasurer*

SPRINGFIELD BRANCH

Mr. Myron B. Diggin, Chief Chemist of Hanson-Van Winkle-Munning Co., Matawan, N. J., was the featured speaker at the February 25 meeting. He was introduced by Librarian Frank J. Clark.

Mr. Diggin presented a very complete discussion of the various types of cobalt-nickel alloy baths, pointing out the advantages and limitations of each and touching on the filtration and purification procedures which must be used. The talk was followed by general discussion.

At the short business meeting there were received one application for membership and one in-transfer from the Waterbury Branch.

PAUL F. LYMAN, *Secretary*

BALTIMORE-WASHINGTON BRANCH

Twenty-three members and guests were present at the meeting on March 5 at the Kenesaw Apartments in Washington. An excellent steak dinner brought back memories of pre-war days.

After the dinner, President Huston opened the business session by introducing the guests. The members of the Banquet Committee were given a vote of thanks for their excellent efforts.

Five new members were elected into the Branch and there was one application for membership.

President Huston stated that the April meeting would include the election of officers for the coming year. This will allow the newly elected officers a short time to work with their predecessors.

Librarian Olson introduced as the speaker of the evening Mr. A. E. Carlson, Supervisor of Development of General Chemical Co., who gave an illustrated talk on "Lead-Tin Alloy Plating from Fluoborate Baths" with special emphasis on bearings plating.

The paper also touched upon fluoborate baths for plating with other metals.

ALBERT G. TAYLOR, *Secretary-Treasurer*

CLEVELAND BRANCH

P. R. Lyons, Librarian pro-tem., introduced Mr. T. O'Neil of the Firestone Steel Products Company as the speaker on March 1. Mr. O'Neil gave a well prepared talk on Brass Plating for Rubber Adhesion. Considerable experimental data were presented. An interesting discussion period followed.

President S. F. Miller then welcomed back from the Service Gene LaSarge, who had been away for some time. L. J. Roll was elected to membership. Mr. Friedel offered a list of four names for membership which was turned over to the Vice President In Charge of Membership, John Honnecker.

Mr. Collins spoke very enthusiastically about the progress being made in the preparations for the Dinner-Dance to be held on March 2, and urged all members who had not done so to pay promptly for the tickets.

HARVEY P. HEIL, *Secretary-Treasurer*

TOLEDO BRANCH

Fifteen members were present at the February 7 meeting.

Mr. Vannarsdall was appointed chairman of a committee to obtain exhibits for the National Convention. Anyone desiring to contribute should bring the articles to the Victor Miner Co., where Mr. Vannarsdall will mount them before they are forwarded to Pittsburgh.

Mr. Barney Case of the Hanson-Van Winkle-Munning Company then gave a much appreciated talk on Bright Nickel Plating.

G. BERGEMAN, *Secretary-Treasurer*

SYRACUSE BRANCH

The feature of the meeting on March 15 was a talk on "Corronizing", given by Mr. L. C. Conradi, Technical Director of the Standard Steel Spring Company. Mr. Conradi explained fully the "how" and the "why" of the Corronizing process, and defined its place in the metal finishing field.

Bob Colvin, Chairman of the Nominating Committee, presented the nominees for the forthcoming Branch election. No further nominations being made from the floor, it was decided to submit the Committee's list of candidates to the membership for letter ballot.

NEIL MAFFEI, *Secretary-Treasurer*

MILWAUKEE BRANCH

At the 366th Regular Monthly Meeting on March 1 at the Red Arrow Club, the following nominations were made: President—Harry Unke and William Geissman; First Vice President—Thomas Davy and James Poulson; Second Vice President—Fred Anderson; Librarian—Ted Hartshorn; Secretary - Treasurer — James Durnford; Board of Managers—Robert Steuernagel, Jr., and Glen Schwemer.

Librarian Hartshorn asked Henry Bornitzke to present his question of the evening: "How to Cure Blistering on Lock Washers". According to the judges, Phil Ritzenthaler and Henry Bornitzke, no correct answer was proposed. Their answer was to pickle in muriatic acid at room temperature and immerse in boiling sodium cyanide solution.

Mr. Hartshorn then introduced Mr. Verne Verzier, Chief Chemist of the Lea Manufacturing Company, who presented some interesting information on the uses of Lea Compounds in polishing.

JAMES DURNFORD, *Secretary-Treasurer*

NEWARK BRANCH

First Vice President John DeVries conducted the regular meeting on March 1, which was attended by 47 members.

A communication from the San Francisco Branch asking for advice on how to conduct a course in The Control of Electroplating Solutions was turned over to George Reuter, who was the instructor for the Newark Branch classes during the period 1930 to 1941.

One application for membership was received.

Our guest speaker for the evening was Williard Hults of Schnefel Brothers, Inc. His talk on "Electropolishing of Metals" dealt mostly with stainless steel. Advantages and limitations of the process were explained. Numerous samples such as nail files, tweezers, forceps and surgical instruments were exhibited.

GEORGE WAGNER, *Secretary*

BUFFALO BRANCH

Librarian Burt Kirshhoff introduced the speaker at the March 8 meeting, Mr. Lankes of Detrex Corporation, Detroit, Michigan. Mr. Lankes gave a very interesting talk on degreasers, illustrated with a number of pictures. He offered many illuminating answers to the questions put from the floor.

J. A. KUSHNER, *Secretary*

MONTREAL BRANCH

The Montreal Branch held the regular monthly meeting at the Mount Royal Hotel on March 11 with 15 members present.

In response to letters from the Chairman of the Research Committee and the Executive Secretary, it was decided to form a special committee to approach all concerns interested in the plating trade and solicit sustaining memberships. Each Branch member will be sent a letter in regard to the request that each member contribute one dollar per year to the Research Fund.

Ross Davidson then conducted a Question and Answer period which created so much interest that the meeting had to be adjourned before all questions were answered.

1.—What is the most common method of replenishing nickel in an ordinary solution and how often should the pH be determined?

2.—What causes nickel salts to crystalize on the outside of bags containing them when hung in the solution?

3.—Is there any method, other than an analysis, of determining when a silver solution requires sodium carbonate or sodium cyanide?

4.—What is the best type of scratch brush for use on costume jewelry with light silver plate? Articles are lead, flashed in nickel.

WM. GLOVER, *Secretary-Treasurer*

Permanent Charters Awarded

The *Rockford Branch*, which obtained a temporary charter in January 1945, was presented with its permanent charter on April 6. President W. L. Pinner made the presentation.

First Vice-President Frank K. Savage awarded a permanent charter to the *St. Joseph Valley Branch* on April 3. This Branch received its temporary charter in May 1945.

Best wishes for a successful future go to these two Branches, their Officers and organizations.

President Pinner Presented Cup at Baltimore-Washington Annual Meeting

At the Baltimore-Washington Branch annual educational session and dinner dance, Saturday evening, February 16, at the Maryland Yacht Club, Baltimore, Md., a very successful educational program, featuring papers on "High Speed Nickel Plating from the High Chloride Ion Nickel Bath" by W. L. Pinner; "Practical Applications of Plating on Aluminum" by R. A. Ehrhardt; and "Heavy Silver Plating on Bearings" by F. C. Mesle, were presented. These papers will appear shortly in the MONTHLY REVIEW.

The entertainment and dinner dance were very successful and well attended. A feature of the affair was the presentation to our president, W. L. Pinner, of a cup by the local Branch.

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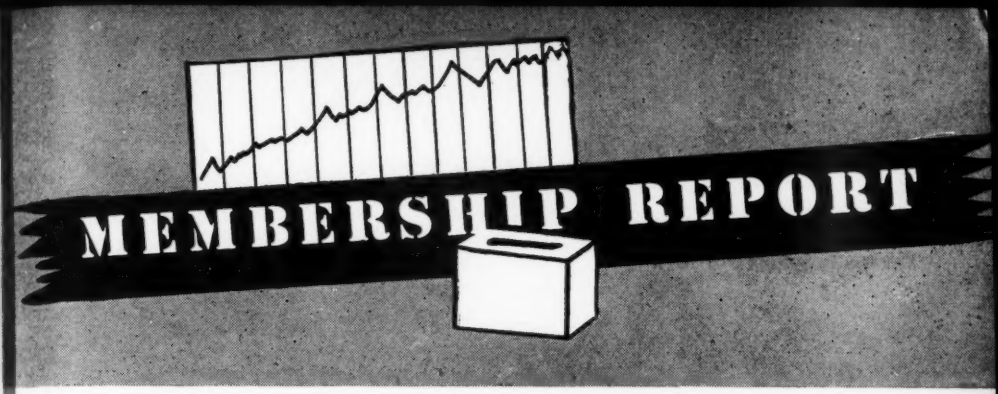


RAYMOND J. O'CONNOR
Chairman, Membership Committee

ELECTIONS

Rockford Branch

Russell G. Yunker, Box 74, Warren, Ill.
Stanley M. Baker, Davenport Plating Wks., 523 W. 4th St., Davenport, Iowa
Severt E. Olson, 1647 Charles St., Rockford, Ill.
Charles S. Kranski, 1332 Revell Ave., Rockford, Ill.
Hollis A. Livingston, 517 N. First St., Rockford, Ill.
Vern T. Wissen, Forest Hills Road, RR2, Rockford, Ill.
Harry L. Soper, 201 E. 20th St., Bellevue, Nebr.
Evan G. Olmon, 1212 E. Shawnee, Freeport, Ill.
Clyde J. Wells, 2218 S. 4th St., Rockford, Ill.

Montreal Branch

G. Lavigueur, 2106 Davidson St., Montreal 4, Quebec, Canada
J. E. Larue, 1025 Sherbrooke St. East, Montreal 24, Quebec, Canada
L. S. Boyd, 122 Keefer St., Ottawa, Ont., Canada

Milwaukee Branch

Wesley Edwards, 2518 N. 59th St., Milwaukee 10, Wis.
Robert Bublitz, 209 W. Page St., Elkhorn, Wis.
Wallace Jarvis, Union Grove, Wis.
Carl W. Schmidt, Metal Coatings Inc., 728 S. 16th Street, Milwaukee, Wis.
Everett Robinson, 1028 W. Capitol Drive, Milwaukee, Wis.
Fred A. Baever, 400 Island Ave., Racine, Wis.

Pittsburgh Branch

Andrew S. Sabol, National Electric Products Corp., Ambridge, Pa.
Wm. H. Wooster, Sr., 32 Keswick St., Pittsburgh 2, Pa.
Garold C. Jenison, P. O. Box 267, Weirton, W. Va.

Providence-Attleboro Branch

Harry A. Cooper, 4 Mill Lane, Taunton, Mass.
Leo LeBlanc, 18 Laurel Hill Ave., Providence 9, Rhode Island
Herbert A. Moore, Jr., 41a Dunham St., Attleboro, Mass.
Gerald H. Noonan, 236 Eddy St., Providence 3, Rhode Island

Indianapolis Branch

Robert C. Bruck, 824 Graham Ave., Indianapolis 1, Ind.
John E. Hoff, Jr., The George J. Mayer Co., 15 N. Pennsylvania St., Indianapolis, Ind.
Harold E. Rinne, 1127 Shelby St., Indianapolis 3, Ind.

Philadelphia Branch

William Stericker, Philadelphia Quartz Co., 121 S. 3rd St., Philadelphia 6, Pa.

New Haven Branch

Thomas A. Ayr, Jr., 145 Elm Street, West Haven, Conn.
John K. Willis, 785 Orange Street, New Haven 11, Conn.
Robert T. Sammet, 93 Under Hill Rd., Milford, Conn.

Melbourne Branch (Australia)

N. W. Harris, 790 Hampton Street, Brighton, Victoria

F. A. Prowse, 13 Lygon Street, South Caulfield, Victoria

J. D. McCarthy, 29 Park Street, Parkville, Victoria

A. T. P. Davies, 27 Hudson St., Caulfield S.E. 7, Victoria

F. R. Quinton, 43 Roxburgh St., Ascot Vale W. 2, Victoria

V. E. B. Cousins, 56 Pitt Street, West Footscray, Victoria

F. J. Sheehan, 134 Epson Road, Ascot Vale, Victoria

T. Clancey, White Street, Maribyrnong W. 3, Victoria

G. Lethbridge, 14 Balaclava Road, East St. Kilda, Victoria

R. G. Abrahams, C/-Henry H. York & Co. Pty. Ltd., 573 Lonsdale Street, Melbourne, Victoria

George A. Noy, 11 Everett Street, W. Brunswick, Victoria

James W. Benge, 844 Swanston Street, Carlton, Victoria

A. H. Chesterfield, 29 Marriott Street, Caulfield S.E. 8, Victoria

F. J. Pearson, C/-Delaney & Young, 2 Little Curyon Street, North Melbourne, Victoria

Percy D. Williams, 30 Hutchinson St., Moonee Ponds, Victoria

J. M. Pierce, 15 Orange Grove, Camberwell, Victoria

W. Higgins, 10 Hyland Street, South Yarra, Victoria

A. K. Dempster, 13 Wallis Ave., East Ivanhoe, Victoria

P. Shiel, C/-Sterling Plating Co., 521 Bridge Road, Richmond, Victoria

J. H. Hay, 316 Bambra Road, Caulfield, Victoria

H. H. Glover, Box 2523, G. P. O. Elizabeth Street, Melbourne, Victoria

J. N. Phelan, 7 Wheatley Road, Bentleigh, Victoria

W. A. S. Newport, 42 Loyola Grove, Burnley, Victoria

L. A. Francis, 53 Brandon Street, Burwood E. 13, Victoria

George T. Browne, 7 Bowles Ave., Caulfield, Victoria

John J. Dale, 25 Hawthorn Road, Caulfield S.E. 7, Victoria

A. McHardy, 132 Mitchell Street, Northcote, Victoria

C. Iretan, 57 Cremorne Street, Richmond, Victoria

G. Miller, 76 Booran Road, Caulfield, Victoria

K. Leigh, 147 Westbury Street, East St. Kilda, Victoria

L. A. Overell, C/-Vanodic Processors Pty. Ltd., 337 Queen Street, Melbourne, Victoria

L. G. Johnson, 205 Dawson St., West Brunswick N. 12, Victoria

F. J. W. Richards, C/-E. B. & S. W. Rogers, Pt. Nepean Rd., Elsternwick, Victoria

A. F. Crotty, 267 Bell Street, Colburg, Victoria

R. Smiley, General Accessories Pty. Ltd., Spencer St. Bridge, South Melbourne S.C. 5, Victoria

W. J. Davies, 29 Coate Ave., Alphington N. 20, Victoria

Mr. May, C/-O. A. Mendelsohn & Co., 386 Flinders Lane, Melbourne, Victoria

J. W. McOrist, 25 Curtin Ave., West Brunswick N. 12, Victoria

G. Rampling, 38 Maysia Street, Canterbury, Victoria

H. C. Cassell, 2 McKenzie Street, Brunswick, Victoria

A. A. Thompson, 14 Peace Street, Glen Iris, Victoria

L. S. Rogers, C/-Gollin & Co. Pty. Ltd., 521 Bourke Street, Melbourne C.1, Victoria

J. W. Ward, C/-Russell Mfg. Co. Pty. Ltd., 81 Burnley Street, Richmond E.1, Victoria

A. B. Pritchard, C/-A. G. Healing Ltd., Franklin Street, Melbourne, Victoria

G. Wholley, C/- K. G. Luke Pty. Ltd., 30 Queens Parade, North Fitzroy N. 7, Victoria

A. Rule, C/- United Engineering & Malleable Co. Pty. Ltd., Gordon St., Footscray, Victoria

H. E. Arblaster, C/- Stokes & Sons Pty. Ltd., Albert Street, Brunswick N. 10, Victoria

C. Swann, 9 Murrumbeena Road, Murrumbeena, Victoria

Mr. Bardsley, C/- Robt. Bryce & Co. Pty. Ltd., 526 Lit. Bourke St., Melbourne C. 1, Victoria

A. L. Glover, C/- Industrial Metal Finishing & Plating Co., 621 Bridge Rd., Richmond, Victoria

Clyde J. Harris, C/ - Edson Plating Co of Australia, Whiteman St., South Melbourne, Victoria

D. C. O'Beirne, 33a Murphy St., South Yarra, Victoria

R. Murley, 15 Prentice Street, East St. Kilda, Victoria

R. C. Dempster, 50 McArthur Rd., East Ivanhoe, Victoria

F. Carr, 23 Wright St., Bentleigh S. E. 14, Victoria

P. Turner, 95 Armstrong St., Middle Park, Victoria

W. Aarons, Flat 2, 74 Mitford St., Elwood, Victoria

Los Angeles Branch

Alfred J. Ahlschlager, Du-Lite Chemical Products, 6021 S. Compton Ave., Los Angeles 1, Calif.

Robert L. Kaas, Russill Plating Works, 1319 Margo Street, Los Angeles 15, Calif.

Carl G. Thiene, 1070 North Raymond Ave., Pasadena 3, Calif.

William Trickey, 2890 Griffin Ave., Los Angeles 31, Calif.

George A. Simpson, 1976 Laura Ave., Huntington Park, Los Angeles, Calif.

John F. Drake, 4686 Santa Fe Ave., c/o Kennard and Drake, Los Angeles 11, Calif.

Newark Branch

John W. Lewis, 14 Race Street, Hillside, New Jersey

Cleveland Branch

L. J. Roll, 2100 Keith Building, Cleveland 15, Ohio

Lancaster Branch

Gilbert Cummins, 2800 Frederick Ave., Baltimore, Md.

Baltimore-Washington Branch

C. H. Sample, Rheem Research Products, Inc., 1409 Standard Oil Bldg., Baltimore 2, Md.

John J. Watkins, 2682 Wilkins Ave., Baltimore 23, Maryland

Y. Yang, 715 Lawrence St. N. E., Washington, D. C.

Hugo Starck, 1830 S. Street S. E., Washington 20, D. C.

John Samuel Brown, 4725-3rd Place N. W., Washington, D. C.

APPLICATIONS

Rockford Branch

Adolf B. Gork, Spengler Loomis Co., Rockford, Ill.

Robert C. Fetters, c/o Kelite Products, 227 N. Wyman, Rockford, Ill.

Ray Williams, 1802 Preston St., Washburn Co., Rockford, Ill.

Henry P. Benson, c/o Western Newell Mfg. Co., Freeport, Ill.

Cyril F. Key, 517 Gregory St., Rockford, Ill.

Cleveland Branch

Arthur G. Portz, 3404 West 151st St., Cleveland 11, Ohio

Ralph J. Everstine, 3248 West 30th St., Cleveland 9, Ohio

Marshall A. Veigel, 763 East 205th St., Euclid 19, Ohio

Newark Branch

Albert W. Payne, 60 Johnson Ave., Hackensack, New Jersey

Mathew Payne, 3 West End Street, Rochelle Park, New Jersey

Theodore Berger, Thomas & Betts Co., 36 Butler St., Elizabeth, New Jersey

Edward J. Roehl, Church Street, Little Silver, New Jersey

Baltimore-Washington Branch

Edward W. Leverett, 1043 E. Main St., Stratford, Conn.

Carl E. Winkel, 82 Scofield Ave., Bridgeport 5, Conn.

Philip L. Wright, Box 155 Route 1, Old Court Road, Woodstock, Md.

Pittsburgh Branch

James W. Nelson, 705 Whitney Ave., Pittsburgh 21, Pa.

F. W. Stockton, Standard Steel Spring Co., Coraopolis, Pa.

Alek Siegel, Box 96, Curtisville, Pa.

Perry T. Thomas, 5639 Rural Street, Pittsburgh 6, Pa.

Ralph D. Manon, Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.
Paul G. Sellger, 812 Fulton Bldg., Pittsburgh 22, Pa.

Providence-Attleboro Branch

Kempton S. Howland, 58 Weybosset St., Providence, R. I.
Milton Lord, 10 First St., Providence, R. I.
Lester J. Dicks, 29 March St., Providence, R. I.

REINSTATEMENTS

Indianapolis Branch

Harry B. Smith, 335 Whittier Place, Indianapolis, Indiana
Robert Strain, 34 S. Colorado Street, Indianapolis, Indiana

Philadelphia Branch

Matthew F. Dudek

Twin City Branch

Frank A. Tschimperley

TRANSFERS

Guy W. Wilberger from Baltimore-Washington Branch to Boston Branch
George J. Mitchell from Cleveland Branch to Dayton Branch
Thomas F. Barron from Providence-Attleboro Branch to Boston Branch
Harold J. Wiesner from Indianapolis Branch to St. Joseph Valley Branch
E. R. Bowerman from Buffalo Branch to Newark Branch
William J. Wood from Lancaster Branch to Los Angeles Branch

RESIGNATIONS

Dayton Branch

Arthur J. German

Baltimore-Washington Branch

Franklin R. Winter
Harry C. Irvin
Dr. Charles Kasper
Philip L. Wright

Twin City Branch

L. P. Guimont

SUSPENSIONS

Dayton Branch
Ohmer L. Stephens

Twin City Branch

B. N. Beck
Donald Norual

DEATHS

Bridgeport Branch

Gerald De Rosa

Attention Members

Revised membership certificates, which, as authorized at the Annual Meeting in June 1945, do not require annual renewal, are now available at $.50 each. Members are urged to place their orders with their Branch Secretaries instead of making individual requests to Society Headquarters.

7th Annual A. E. S.

New England Regional Meeting

Hotel Bond
Hartford, Conn.

Saturday, May 11, 1946

2:00 P. M.

Presenting the following program:

"Plating of Zinc Base Die Castings"
by DWIGHT M. OVERCASH

"Practical Technique of Polishing and Buffing"
by HOWARD MCALEER

"Seeing Anode and Cathode at Work"
by DR. WALTER MEYER

To be followed by a Banquet

A Swell Show!

A Top Orchestra!

Numerous Door Prizes!

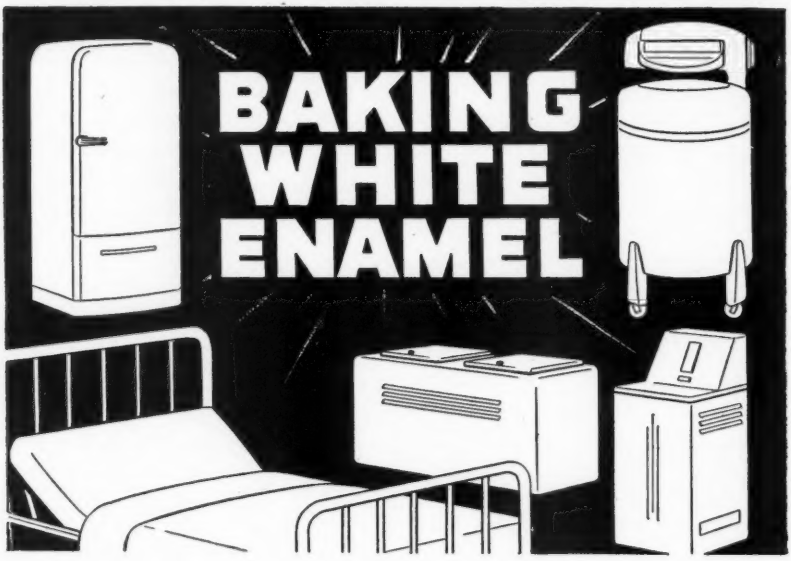
MEMBERSHIP CHART

BRANCH	May 1945	Change in Membership	Percent Change
FIRST GROUP			
LOS ANGELES	151	+25	+16.6
CLEVELAND	143	+20	+14.0
PHILADELPHIA	154	+15½	+10.1
DETROIT	390	+34	+ 8.7
NEWARK	213	+16½	+ 7.7
WATERBURY	122	+ 8½	+ 7.0
BALTIMORE-WASH.	122	+ 8	+ 6.6
NEW YORK	191	+11	+ 5.8
BOSTON	157	+ 5½	+ 3.5
HARTFORD	126	+ 2½	+ 2.0
GRAND RAPIDS	121	+ 1	+ 0.8
CHICAGO	357	+ 2½	+ 0.7
SECOND GROUP			
PITTSBURGH	80	+10½	+13.1
PROV.-ATTLEBORO	101	+12	+11.9
MILWAUKEE	107	+12½	+11.7
TORONTO	119	+12	+10.1
ROCHESTER	90	+ 8	+ 8.9
INDIANAPOLIS	112	+ 5½	+ 4.9
BRIDGEPORT	118	+ 5½	+ 4.7
NEW HAVEN	106	+ 3½	+ 3.3
SPRINGFIELD	73	+ 1	+ 1.4
BUFFALO	89	+ 1	+ 1.1
ST. LOUIS	116	+ ½	+ 0.4
DAYTON	109	—11½	—10.5
THIRD GROUP			
ROCKFORD	23	+24	+104.2
SYDNEY	51	+31	+ 60.8
JACKSON-LANSING	62	+18	+ 29.0
TWIN CITY	52	+14½	+ 27.9
SAN FRANCISCO	55	+15	+ 27.3
SYRACUSE	57	+ 7	+ 12.3
TOLEDO	54	+ 5½	+ 10.2
LANCASTER	39	+ 1	+ 2.6
CINCINNATI	57	+ ½	+ 0.9
MONTREAL	54	— 2½	— 4.6

Membership May 1, 1945 = 3,972
Membership Apr. 1, 1946 = 4,406

Gain in Membership = 434
Per Cent of Gain = 11.0

Here is Egyptian's new Baking White Enamel



Resistant to:

ABRASIVES • ACIDS
ALKALIS • SALT SPRAY • HUMIDITY
WATER IMMERSION and
SOFTENING ACTION of FATS and OILS

Spray it on clean bare metal. Needs no primer. Bakes fast to a hard, glossy finish.

Put Your White Finish Problems Up to Us

THE EGYPTIAN LACQUER MANUFACTURING COMPANY
ROCKEFELLER CENTER, NEW YORK 20, N. Y.

EGYPTIAN FINISHES

EGYPTIAN
SPECIALIZED PRODUCTION FINISHES

INDUSTRY NEWS

Position Wanted

Electrochemist, B.S. degree, ten years' experience including chemical control of electroplating processes, plating department production management and heat treating, desires position as plating foreman of supervisory nature in which his experience can be fully utilized. Philadelphia area preferred although willing to consider favorable opening elsewhere. MR-4B, MONTHLY REVIEW, P.O. Box 168, Jenkintown, Pa.

Plating Engineer

Situation Wanted — Electroplating Supervision: Graduate Chemical Engineer, 35 years old. Ten years' experience in all types of commercial electroplating and electroforming, including field engineering work with large licensing and servicing organization, four years in charge of research and development program in iron, nickel, and copper electroforming, and past four years in charge of all production at electroforming plant in Midwest. Good background in design and engineering of plating room installations. Desires suitable connection in electrodeposition work in Southern California. MR-4A, MONTHLY REVIEW, P.O. Box 168, Jenkintown, Pa.

Manderscheid Moves to New Quarters

To provide space for increased manufacturing capacity necessary to meet the demand for Presto Products, The Manderscheid Company has moved to 810 Fulton St., Chicago 7, Ill. Floor space at the new address is three times that formerly occupied at 605 W. Washington Street.

New Pickle Tank For Sale

Hanson - Van Winkle - Munning double station hot sulphuric lead lined pickle tank with lead pipe and lead lined heating coil; including Mercil type drive with ½ HP—3 phase—60 cycle —220 volt motor, gear reducer and 2 gear boxes for rotating baskets in pickle tank. Serial number C 1785. WEST BEND ALUMINUM CO., West Bend, Wisconsin.

Chemist Wanted

Chemist-Salesman, free to travel. Write only. Sulphur Products Co., Greensburg, Pa.

Finishing Foremen:
BURNS ALUMINITE PASTES, iron oxide free, have proven better than Emery pastes for polishing stainless steel. Will remove weld marks and match up original Mill Finishes as #4. Five standard grits.
Write for samples and information.

E. Reed Burns Mfg. Corp.
BROOKLYN 11, N. Y.
Since 1888
The "Know How" People

New Address for Rheem Research Products, Inc.

As of April 1st, 1946, the manufacturing and sales operations of the Eastern Division of Rheem Research Products, Inc., manufacturers and marketers of Iridite, will be located at 4004 East Monument Street, Baltimore 5, Maryland. The Company's Research Laboratories will remain at 1209 East 25th Street, Baltimore 18, Maryland.

Non-Hazardous Metal Pickling and Bright Dip Agent

A 20-page, well organized Bulletin describes Troxide, a metal pickling and bright dip agent which is free from the hazards that characterize ordinary chemicals used for such service. Selective, controlled action which destroys less metal than ordinary acid pickles while effectively producing desired results at lower costs is another advantage claimed for Troxide. The Bulletin details formulae for pickling and bright dipping a variety of metals. A convenient at-a-glance chart summarizes these formulae and their uses. This useful literature piece, which should make a valuable addition to any metal plating and finishing library, can be had on request from Waverly Petroleum Products Co., Dept. MR, Drexel Bldg., Philadelphia 6, Pa.

A. J. Cassatt Named to Pennsalt Board

Alexander J. Cassatt, Vice President of the Western Saving Fund, was elected recently to the Board of Directors of the Pennsylvania Salt Manufacturing Company.

Mr. Cassatt, who was a Naval Lieutenant Commander during the war, is a grandson of the late A. J. Cassatt, President of the Pennsylvania Railroad at the time New York's Pennsylvania Station and the railroad's tunnel under the Hudson river were built.

Mr. Cassatt, a Trustee of the Drexel Institute of Technology, also is a director of the Electric Storage Battery Company, the Pennsylvania Company for Insurance on Lives and Granting Annuities, the Fire Association of Philadelphia, Reliable Insurance Company, the Pennroad Company, and the American Briquet Company.

For

OXIDIZING

and

STRIPPING COPPER PLATE

use

McKeon's

"Liquid Sulphur"

TRADE MARK REG'D

For

STRIPPING TIN

use

McKeon's

Tin-Strip

TRADE MARK REG'D

Information or samples on request

Sulphur Products Co.

Greensburg 9, Pa.

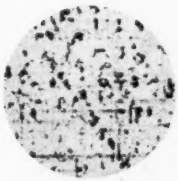
Crane Equipment and Supply Co. Opens New Office

The Crane Equipment & Supply Co. of Waterbury, Conn., announce the opening of an office in Providence, R. I., located at 1122 Hospital Trust Bldg. This office will be under the management of Mr. Raymond L. Mitchell, who is well known in this territy, having served for several years as field engineer for the Detrex Corp. on metal cleaning problems. Mr. Mitchell is a member of the Providence-Attleboro Chapter of the A. E. S.

The branch office will specialize in the solvent degreasing field, representing the Mechanical Process Co., manufacturers of the D'Oiler manual and automatic degreasing machines, and will stock in its Providence warehouse Tromex (trich-lor-ethylene) and Westvaco's perchlorethylene.

Another service offered through this office will be the recovery of waste solvents and thinners from washing and stripping operations through representation of Solvents Recovery Service, Inc., of Newark, N. J., for which Crane Equipment has long been New England agents.

Through a recently established plant at Waterbury, Crane Equipment & Supply Co. is now in a position to offer a complete plating rack service, including designing, building, and insulating. The insulation material featured is the non-oxidizing plastic, Duoplastix, manufactured by Wyandotte Paint Products Co., Wyandotte, Michigan.



Typical one-bath process. Poor color and density. Insufficient protection and sharp edges.

Two baths produce dense color, superior rust protection, equalized grain, reduced friction.

Microphotographs taken on identical steel surfaces by an impartial laboratory.

Finish the Job Right with PENTRATE

(PHYTANIUM-BLENDED)

The only patented 2-BATH Process
(Patent No. 2,192,280)

Pentrate offers permanent solution stability in a black finish for steel. This two-bath process is patented.

For certain alloy steels Pentrate is the *only* process that will guarantee proper and uniform blackening. For all steels it furnishes a better finish in a shorter time.

Write for your free catalog today.

HEATBATH CORPORATION
Springfield 1, Massachusetts

IN CANADA
William J. Michaud Co., Ltd., Montreal

Diversey Elects C. E. Glasser, Treasurer

C. E. Glasser has been elected Treasurer of The Diversey Corporation. C. E. Glasser started with Diversey in 1928 and has held many responsible positions with the company including that of a department and Division manager. Mr. Glasser is a director of the Dairy Industries Supply Association. In 1942 and 1943, he served as chairman of DISA's War Problems Sanitation Products Sub-Committee. He was also a member of that organization's Special Advisory Sub-Committee and a member of the War Problems Committee.

Since 1939, Mr. Glasser has carried the title of Assistant to the President.

Dehn Appointed Magnuson Sales Manager

Edward Magnuson, president of the Magnuson Products Corporation, manufacturer of industrial cleaning compounds, announces the appointment of George W. Dehn as sales manager. Mr. Dehn has been connected with the cleaning, plating, and finishing industry, having traveled through the Midwest for the past 20 years, representing the Zapon Company, Division of Atlas Powder Company. He will be located at the home office of the Magnuson Products Corporation at 50 Court St., Brooklyn 2, N. Y.

FOR SALE **Available for Immediate Shipment**

1—2500/1250 AMPERE, 12/24 VOLT, **CHARLES J. BOGUE ELECTRIC CO.** Motor Generator Set. Separately Excited. Excellent Condition. Full Controlling Equipment.

1—2000/1000 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE CO.** (INTERPOLE TYPE) Motor Generator Set. Complete Controlling Equipment. Excellent Condition.

1—1600 AMPERE, 30 VOLT, **WESTINGHOUSE** Motor Generator Set. Complete Controlling Equipment. Excellent Condition Throughout.

8—1440/720 AMPERE, 6/12 VOLT, **UDYLITE-MALLORY RECTIFIERS**—Input Rating: 220/440 volts, 3 phase, 60 cycles. Excellent Condition.

1—1000/500 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE CO.** (INTERPOLE TYPE), Motor Generator Set. Excellent Condition.

1—750/375 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE CO.** Motor Generator Set. Excellent Condition. Full Controlling Equipment.

20—60 AMPERE, 14 VOLT, **CROCKER-WHEELER ELECTRIC CO.** Motor Generator Sets (Brand New). Full Controlling Equipment.

ANODIZING MOTOR GENERATOR SETS

1—1000 AMPERE, 50 VOLT, **CHANDEYSSON ELECTRIC CO.** SYNCHRONOUS-DRIVEN Motor Generator Set, complete with Exciter and Full Controlling Equipment.

1—500 AMPERE, 60 VOLT, **WESTINGHOUSE** Motor Generator Set, complete with Full Controlling Equipment.

2—500 AMPERE, 40 VOLT, **MOTOR GENERATOR CORPORATION** Motor Generator Sets. Excellent Condition. Full Controlling Equipment.

1—500 AMPERE, 24 VOLT, **HANSON & VAN WINKLE CO.** (INTERPOLE TYPE) Motor Generator Set. Excellent Condition. Full Controlling Equipment.

M. E. BAKER COMPANY **143 SIDNEY STREET CAMBRIDGE, MASS.**

Zapon Appoints Metz Technical Service Manager

Donald A. Metz, of New York, has been appointed Manager of Technical Service for the Zapon Division of Atlas Powder Company, according to an announcement by E. H. Bucy, Assistant General Manager. The Zapon Division manufactures industrial finishes at plants in Stamford, Conn., and North Chicago, Ill. Mr. Metz will be located at Stamford. He is organizing a service which will enable the company to further the technical and sales interests of its customers in the industrial finishes field.

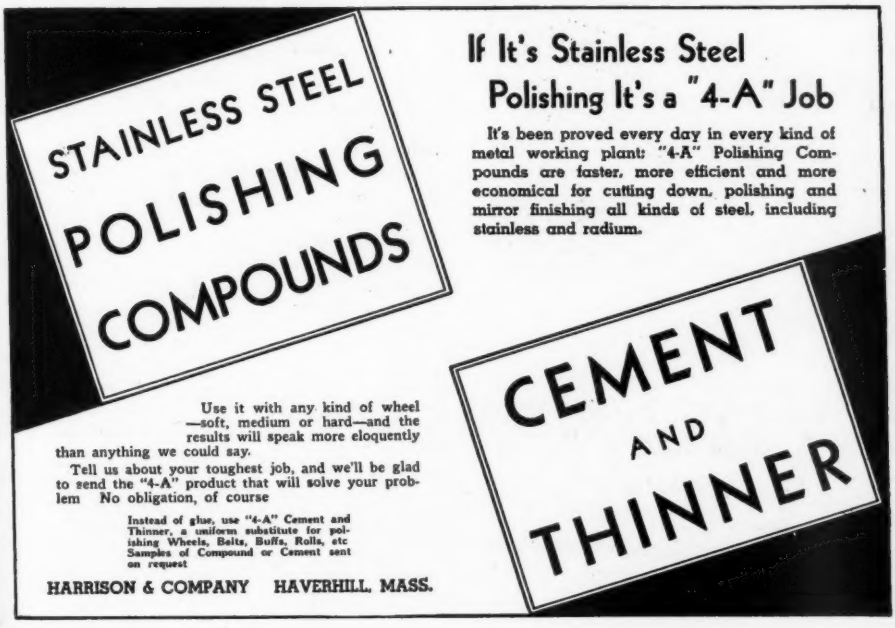
Mr. Metz is the son of Herman A. Metz, former Comptroller of New York City and well-known in the color and chemical industries.

A graduate of Sheffield Scientific School of Yale in 1937, Mr. Metz was recently released from the army with the rank of Lt. Col. He was in charge of organizing and operating the Paint and Chemical Laboratory at Holabird Depot, Baltimore, Md., and later at Aberdeen Proving Ground. As Chief of the Laboratory, he directed research and development on the first lusterless finishes used by the army for automotive equipment and later on all ordnance material. The Laboratory was also responsible for specifications and testing of such materials as cleaning compounds, anti-freeze compounds, brake fluids, plastic packaging materials, etc., used by the Ordnance Department. Mr. Metz worked in close cooperation with the industrial finishes industry throughout the war to help provide a continuous flow of raw materials which could meet specifications despite various material shortages.

Prior to entering the army, Mr. Metz was associated with the Winthrop Chemical Company as Assistant Divisional Manager, contacting the medical, pharmaceutical and hospital fields in and around New York City,

Plating Bath Filter Data

An efficient and economical method of clarifying both alkaline and acid plating solutions is presented in a bulletin file prepared by the Commercial Filters Corp., A. and West Third Sts., Boston 27, Mass. Included is a bulletin illustrating and describing the Fulflo filter and honeycomb filter tube, data sheets on the filtration of electroplating solutions, as well as separate bulletins on the various modes of Fulflo filters. The bulletin file is offered free to interested individuals upon request.


STAINLESS STEEL
POLISHING
COMPOUNDS
If It's Stainless Steel Polishing It's a "4-A" Job
It's been proved every day in every kind of metal working plant: "4-A" Polishing Compounds are faster, more efficient and more economical for cutting down, polishing and mirror finishing all kinds of steel, including stainless and radium.
CEMENT
AND
THINNER
Use it with any kind of wheel —soft, medium or hard—and the results will speak more eloquently than anything we could say.
Tell us about your toughest job, and we'll be glad to send the "4-A" product that will solve your problem No obligation, of course
Instead of glue, use "4-A" Cement and Thinner, a uniform substitute for polishing Wheels, Belts, Buffs, Rolls, etc Samples of Compound or Cement sent on request
HARRISON & COMPANY HAVERHILL, MASS.

Kelly Appointed Sales Engineer for Indiana by Udylite

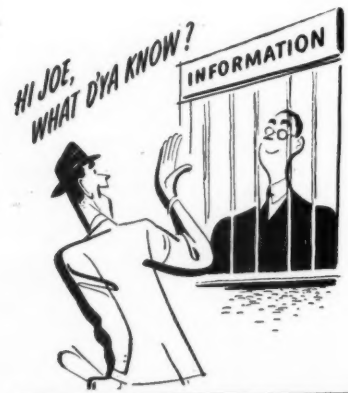
Mr. Vincent R. Kelly of Indianapolis (27 Westfield Blvd.) has been appointed by The Udylite Corporation of Detroit as Sales Engineer for the Indiana territory under the supervision of the Cleveland Branch Office.

Although a native of New York State, he has been in Indianapolis for the past five years handling heat treating and plating for Curtiss-Wright. Previous to that he served in the heat treating department of Curtiss-Wright's Clifton, New Jersey plant and in a similar capacity with the New Process Gear Company of Syracuse, N. Y.

He is a member of the Society of Automotive Engineers and also of the American Society for Metals.

New Iridite Process Adds Brilliance, Corrosion Resistance to Zinc, Cadmium Plate

Iridite Bright, a chemical treatment that produces a mirror-bright, transparent, chromate film on zinc or cadmium plated parts, has been added to the line of Iridite finishes manufactured and marketed by Rheem Research Products, Incorporated, Baltimore, Maryland.



WE HAVE ALL THE ANSWERS!

. . . For over fifty years, G. S. Blakeslee & Co. have been engineers of cleaning equipment. Many problems have been solved and many bottle-necks in the production line eliminated with Blakeslee Metal Parts Washers and Solvent Degreasers.

G. S. Blakeslee & Co. would appreciate the opportunity of giving you the information that will help solve your metal parts cleaning problems.

Write for free informative booklet.

BLAKESLEE
Solvent Vapor DEGREASERS
Metal Parts WASHERS

STANDARD AND SPECIALS Engineered for you

G. S. BLAKESLEE & CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

Unlike an ordinary bright dip, Iridite Bright forms an entirely new, corrosion resistant finish on the surface of the metal. The Iridite Bright coating greatly reduces fingermarking and will not fade or tarnish.

No electric current is used by the process. Parts being treated are immersed in the Iridite Bright solution for only 5 seconds, followed by the usual rinsing and drying. A low-concentration caustic rinse is sometimes used following the rinse after Iridite Bright to yield an even more brilliant finish.

Laboratory prepared test panels of Iridite Bright over zinc plate showed no signs of white corrosion after 100 hours exposure to salt spray under U. S. Bureau of Standards Specifications. Untreated zinc panels, of course, showed white corrosion in less than 24 hours.

Other tests have shown that the Iridite Bright offers no resistance to soldering when applied over cadmium plate. In fact, on parts that must be stored between finishing and soldering, the Iridite Bright coating has been found to facilitate soldering.

It is expected that Iridite Bright will find wide use in almost every branch of industry where a bright, corrosion resistant finish is required.

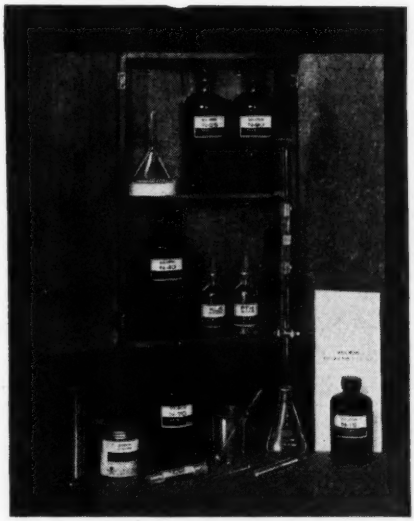
Second National Electronic Conference

The Second National Electronic Conference sponsored by the Illinois Institute of Technology, Northwestern University, and the Chicago sections of AIEE and IRE with the cooperation of the Chicago Technical Societies Council and the University of Illinois will be held at the Edgewater Beach Hotel in Chicago from October 3rd to 5th inclusive.

The nation's outstanding authorities on the theory and applications of this ever-broadening science will be heard in morning, afternoon, and evening sessions scheduled for each of the three days. Panel discussions will be arranged on an industry basis so that delegates may concentrate on their special fields of interest. Details of the program will be announced as fast as final arrangements can be made.

Spoerl Made General Sales Manager, Mechanical Goods Division of U. S. Rubber

The appointment of Walter F. Spoerl as general sales manager of the mechanical goods division of United States Rubber Company has been announced by Ernest G.



CHROMIUM
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Simple test sets for aid in controlling plating and other solutions.

Write for literature.

KOCOUR CO.

4725 S. CHRISTIANA AVE.

CHICAGO 32, ILL.

Specify Kocour Sets from your supplier.

Brown, vice president and general manager of the company's mechanical goods general products and "Lastex" yarn and rubber thread divisions. Mr. Spoerl succeeds Herman A. Everlien, who died suddenly February 21 after 43 years with the company.

Mr. Spoerl began his rubber career 38 years ago as a clerk in the company's sales offices in Chicago. He rose through various sales and administrative positions to become merchandise manager of the mechanical goods division in 1944, the position he held at the time of his new appointment.

Products of the mechanical goods division include conveyor and transmission belts, hose, rubber mountings, packing and hundred of other rubber industrial products.

New 3-Core Solder Offers Wide List of Advantages

Tri-Core, the solder with three independently filled cores of pure rosin flux is a new development of Alpha Metals, Inc., Brooklyn, N. Y. This new product offers users faster soldering and elimination of dry joints, in addition to substantial savings in tin.

A continuous supply of high grade noncorrosive rosin flux is always present in Tri-Core Solder, as the three cores are completely independent of each other. With these three cores, occurrence of "dry" sections in more than one core at a given point is mathematically unlikely, making Tri-Core more efficient and less wasteful than the usual single core solder.

Tri-Core offers the proper fluxing that is vital to good soldering. The arrangement of the three cores places them closer to the surface. Since the walls are thinner than those of single core solder, not alone does the solder melt more quickly, but the heat penetrates to the flux more rapidly, allowing it to flow freely and reach the work ahead of the molten solder. Tests prove Tri-Core does a faster job with less tin — and permits more joints per pound of solder.

Careful cross-sectional proportioning and the absence of surface seams prevent premature sweating out of the flux, making it clean to handle at all times.

Tri-Core solder exceeds A.S.T.M. Class A specifications and is available in all alloys, all flux percentages and all gauges. Bulletins and Engineering Test Samples are available from Solder Development Division, Alpha Metals, Inc., 369 Hudson Ave., Brooklyn 1, N. Y.

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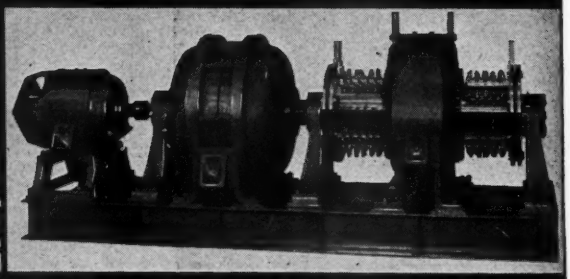

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Robert H. Ehret Joins the Electric Products Company

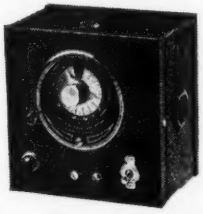
The Electric Products Company, 1725 Clarkstone Road, Cleveland 12, Ohio, announces the addition of Robert H. Ehret to the Headquarters Sales Staff. Mr. Ehret will be responsible for handling headquarters sales negotiations.

Mr. Ehret brings to his new position a broad experience in electrical sales and engineering gained from 1½ years training with General Electric Co. and Electric Machinery Co. plus 11 years selling, applying and installing apparatus manufactured by the Burke Electric Co.

Lighting Fixture Display Scheduled for International Lightning Exposition

Following the Spring Conference of the National Electrical Wholesalers' Association, the International Lighting Exposition will convene in Chicago's Stevens Hotel, April 26-30. While the Exposition's primary purpose will be to answer the question "What's New in Lighting", local platers no doubt will be interested in the display of 60 exhibiters who will show the newest in lighting equipment and products directly related to its manufacture such as paint, etc.

on the job for **TIMING PRECISION**



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A new Timer designed to give the highest degree of precision control. The Series 5 Timer will command visual and audible attention the instant a time interval is completed. This Signalling Timer provides for the automatic closing or opening of a circuit at the end of elapsed time. As an indication of the versatility of the Signalling Timer, it will also operate additional buzzers, bells or lights at remote locations.

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Motor, slow speed—self-starting
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Many Processes Will be Affected by New Electronic Controls

Hundreds of industrial processes in the chemical, metal, food, petroleum and many other fields will be favorably affected by the introduction next month of a series of new developments in industrial electronic control instruments, it was made known by L. Morton Morley, vice president in charge of sales of Brown Instrument Company, Philadelphia industrial division of Minneapolis-Honeywell Regulator Company.

The new developments, according to Morley, will extend the uses to which electronic control instrumentation can be put, particularly in obtaining higher quality control through continuous balance rather than intermittent action. Economies and speedier output will also result, it was added.

The developments announced by Brown company include a front-set mercury switch type control for circular chart electronic potentiometers, back-set mercury type auxiliary switch for both circular and strip chart electronic potentiometers, thermocouple and component failure protection for both electronic models, and external chart drive switches, and omission of internal power switches.

The new instruments, parts and accessories, it was said, will include numerous available variations tailored to a specific industry or process. The new developments will be available for delivery on or about April 1.

Wyandotte Chemicals Research Department Holds Seminar

The 61 technically trained staff members of the Wyandotte Chemicals Research Department recently held a three session seminar at the Detroit Book-Cadillac Hotel. One session was devoted to scientific activities within the department and one to corporation and management topics. At the dinner meeting, Walter J. Murphy of Washington D. C. and editor of the American Chemical Society reported on his tour of German chemical plants shortly after V-E Day.

An incidental part of the technical discussion was the disclosure that the Spectro-Chemical laboratory of the Wyandotte organization is able to make electron microscopic measurements of 1/100 of a micron, or 1/2,500,000 of an inch. The electron microscope and other spectrographic equip-

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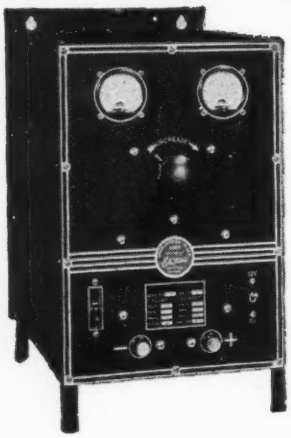

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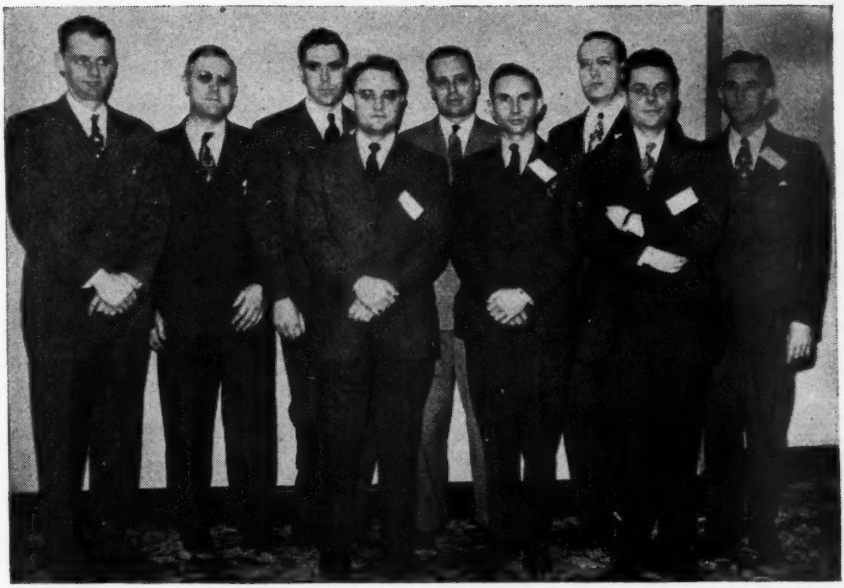

ment is regularly used by the Wyandotte laboratories in both control and development activities. Technical papers presented by 8 staff members of the department treated with problems prevalent in the several industries served by Wyandotte Chemicals with their various compounds and organic and inorganic chemicals. These papers included a wide range of subjects including "Application to Physical Techniques To Chemical Research", "Synergism", "Current Trends in Chemical Patents", and "Synthesis and Evaluation of Mildewproofing Agents".

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From MONTHLY REVIEW page 140, February, 1940:

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(*Continued on next page*)

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(*Continued from preceding page*)

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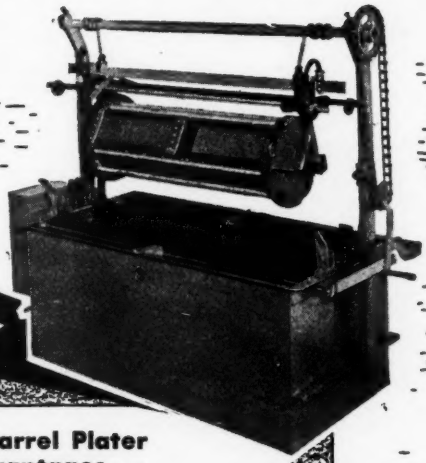

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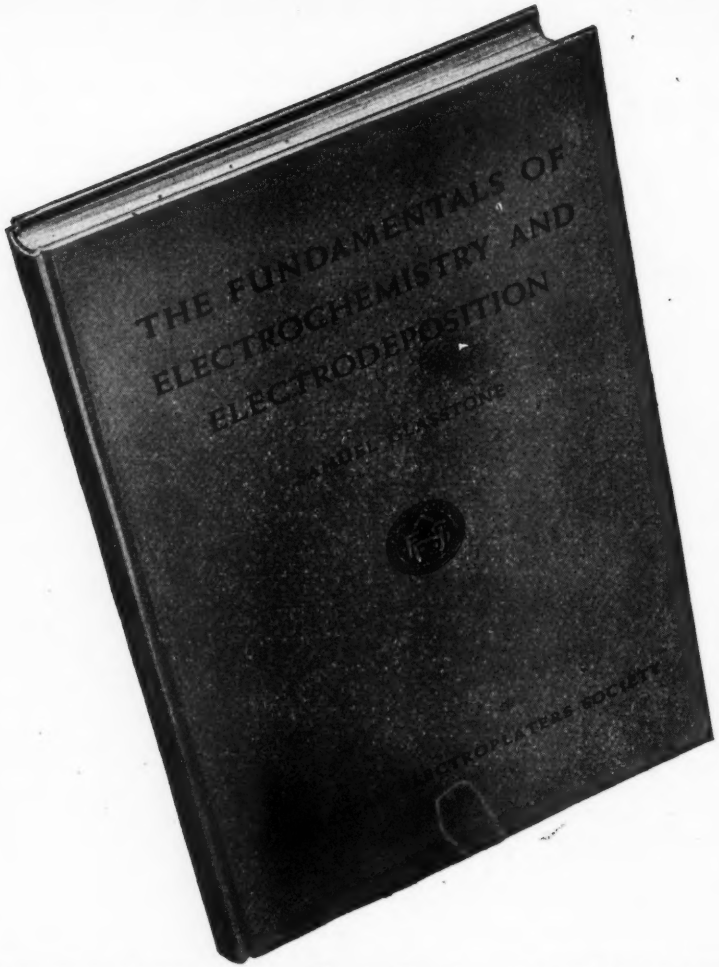

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INDEX TO ADVERTISERS

A

Abbott Ball Company, The 450
Alsop Engineering Corp. 424
American Chemical Paint Co. 418

B

Bacon Felt Company 416
Baker Company, M. E. 442
Blakeslee & Co., G. S. 444
Burns Mfg. Corp., E. Reed 439

C

Ceilcote Company, The 452
Codman Co., F. L. & J. C. 361
Columbia Electric Mfg. Co. 446
Cowles Detergent Co. 356
Crane Equipment & Supply Co. 452

D

Darco Corporation 400
Detrex Corporation 363
Divine Brothers 451
Du Pont de Nemours & Co., Inc. 352-353

E

Egyptian Lacquer Mfg. Co. 438

G

General Chemical Co. 399
Gumm Chemical Co., Fred'k. Second Cover

H

Hanson-Van Winkle-Munning Co. 406-407
Harshaw Chemical Co., The 423
Harrison & Company 443
Hay Company, Jacob 452
Heatbath Corporation 441

I

Industrial Filter & Pump Co. 360
Industrial Timer Corp. 447

K

Kirk & Blum Mfg. Co. 451
Kocour Company 445

L

Lasalco, Inc. 457
Lea Mfg. Company ..... Back Cover
L'Hommedieu & Sons Co. 364

M

Maas & Waldstein Co. 370
MacDermid, Inc. ..... 462 & Third Cover
Magnuson Products Corp. 451
Magnus Chemical Co. 389
McGean Chemical Co. 368
Meaker Company, The 432
Michigan Buff Company 452
Michigan Bleach Co. 409
Mitchell-Bradford Chemical Co. 454

N

Nankervis Company 410

O

Oakite Products, Inc. 351
Optimus Equipment Co. 420

P

Packer Machine Co. 369
Pennsylvania Salt Mfg. Co. 392-393
Pittsburgh Plate Glass Co. 390
Promat Div., Poor & Co. 362
Puritan Mfg. Co., The 365

R

Richardson-Allen Corp. 448

S

Seeley Company, E. E. 451
Sparkler Mfg. Co. 366
Stevens Co., Frederic B. 354
Storts Welding Company 426
Stutz Mfg. Co. 449
Sulphur Products Co. 440

U

Udylite Corporation 460
United Chromium, Inc. 359, 367
U. S. Stoneware Co. 415

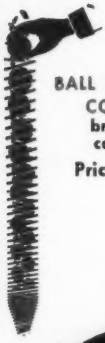
W

Wyandotte Chemical Corp. 357

Z

Zapon Div., Atlas Powder Co. 358

MANY HARD TO GET ITEMS OF *Equipment*

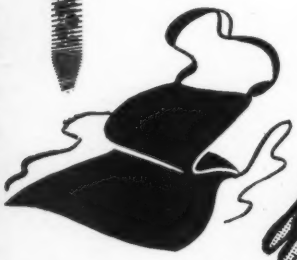


BALL ANODES AND CONTAINERS
brass—copper—cadmium—zinc
Prices on request

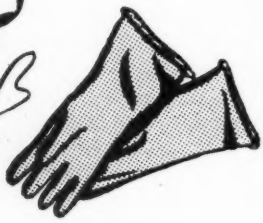
HARD RUBBER ACID PAILS
12 qt. cap
$7.50 each

NOW AVAILABLE FOR EARLY DELIVERIES

MAC DERMID INCORPORATED is the exclusive representative for several leading manufacturers of metal finishing, cleaning and plating equipment. These are now available for immediate or future deliveries to New England manufacturers—from Waterbury warehouses.



KOROSEAL APRONS
Indestructable and acid resistant
$3.00 each



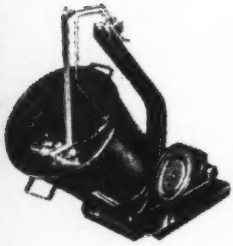
NEOPRENE GLOVES
Recommended better than rubber for toughness and acid resistance
$24.00 a doz.

NEW ENGLAND MANUFACTURERS

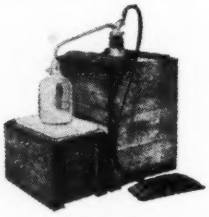
Consider your immediate and future needs for every type of metal finishing, cleaning and plating equipment—then consult our representative. We still have many hard to get items in stock or on order for early shipments from the manufacturer.

Write for Our Equipment List

We will be pleased to mail you our special bulletin alphabetically listing metal finishing, cleaning and plating equipment and supplies that are now available for immediate or early deliveries or if you have a problem concerning the equipment you may need, our New England service engineers will be pleased to assist you in your selection.



HANDIPLATER
A complete plating unit to relieve large units of small jobs
$131.00 each



PNEUMATIC ACID PUMP
With Saran Flexible Tube
$10.50 each
With lead tube and adapter
$9.25 each

ALL PRICES F.O.B. SHIPPING POINT

ROCHELTEX

NEW LIQUID ADDITION AGENT FOR CYANIDE COPPER PLATING

ROCHELTEX is an entirely new formula recently developed in MAC DERMID INCORPORATED laboratories for the speeding up and improving of cyanide copper plating operations.

Through the use of ROCHELTEX as an addition agent for cyanide copper plating, brighter, more uniform copper deposits may be obtained at higher current densities. Buffed diecastings may be plated with copper and directly nickel or chrome plated without buffing.

RETURN THIS COUPON NOW!

Mail this coupon today for our free technical Data Sheet on ROCHELTEX or have our technical service engineer, located in your territory, call at your convenience.

MAC DERMID INCORPORATED
Waterbury 88, Connecticut

Gentlemen: ☐ Please mail me your technical Data Sheet on ROCHELTEX. ☐ Have your representative call.
☐ Mail us one of your equipment and supply lists.

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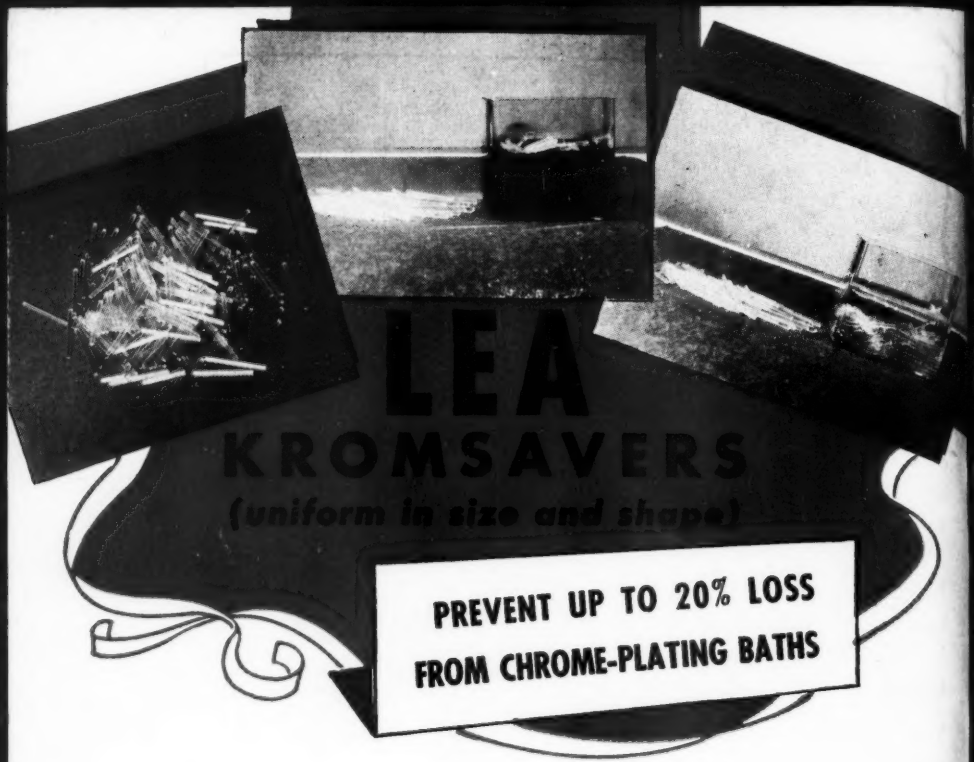


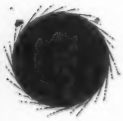
LEA KROMSAVERS

(uniform in size and shape)

PREVENT UP TO 20% LOSS FROM CHROME-PLATING BATHS

HOW is chromic acid lost from the plating bath? Some of it, of course, is dragged out when dripping work is lifted out for rinsing. Most of it, however, is swept out continuously as a mist by the necessary ventilating fan during plating.

The use of LEA KROMSAVERS minimizes such losses. Floating on the surface, they completely cover the surface of the bath but in no way interfere with operations. They form a blanket to keep the suction from drawing off this mist. Solid objects when introduced into or withdrawn from the bath readily part this blanket but with LEA KROMSAVERS the opening is immediately closed over. The uniform size and shape of the KROMSAVERS is largely responsible for this "closing of the gap." A covering of different sizes and shapes would not as readily close up when parted.



And there is no mechanical loss of LEA Savers. Should a few "sticks" adhere to the work and go over into the rinsing tank, they would sink to the bottom and thus not overflow to clog the drain or be lost.

LEA KROMSAVERS quickly pay for themselves. Write or call for prices and deliveries.

THE LEA MANUFACTURING CO.

Waterbury 86, Connecticut

Burring, Buffing and Polishing . . . Manufacturers and Specialists in the Development of Production Methods and Compositions

NAVY